

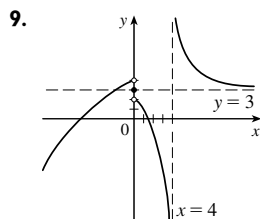
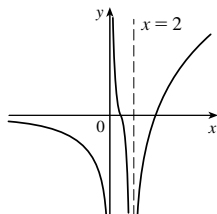
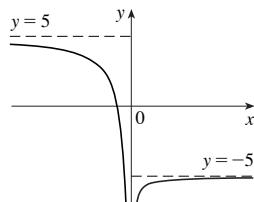
**EXERCÍCIOS 2.6**

1. (a) Quando  $x$  se torna grande,  $f(x)$  aproxima-se de 5.  
 (b) Quando  $x$  se torna um negativo grande (em módulo),  $f(x)$  aproxima-se de 3.

3. (a)  $\infty$  (b)  $\infty$  (c)  $-\infty$  (d) 1 (e) 2

- (f)  $x = -1, x = 2, y = 1, y = 2$

5. 7.



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

23. 3 25.  $\frac{1}{6}$  27.  $\frac{1}{2}(a-b)$  29.  $\infty$  31.  $-\infty$

33.  $\pi/2$  35.  $-\frac{1}{2}$  37. 0 39. (a), (b)  $-\frac{1}{2}$

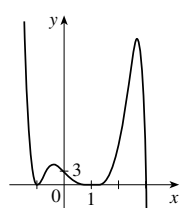
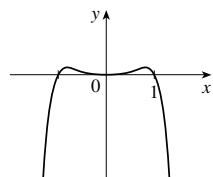
41.  $y = 2, x = 2$  43.  $y = 2; x = -2, x = 1$  45.  $x = 5$

47.  $y = 3$

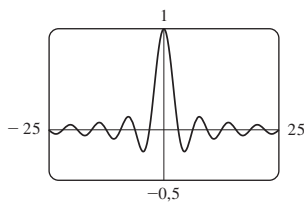
49.  $f(x) = \frac{2-x}{x^2(x-3)}$

51. (a)  $\frac{5}{4}$  (b) 5

53.  $-\infty, -\infty$  55.  $-\infty, \infty$

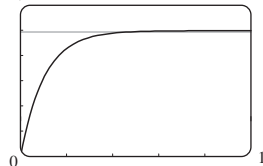


57. (a) 0 (b) Um número infinito de vezes



59. (a) 0 (b)  $\pm\infty$  61. 5

63. (a)  $v^*$  (b) 1,2  $\approx 0,47$  s

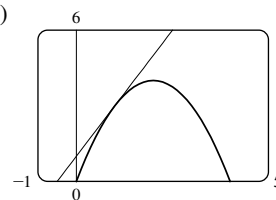


65.  $N \geq 15$  67.  $N \leq -6, N \leq -22$  69. (a)  $x > 100$

**EXERCÍCIOS 2.7**

1. (a)  $\frac{f(x) - f(3)}{x - 3}$  (b)  $\lim_{x \rightarrow 3} \frac{f(x) - f(3)}{x - 3}$

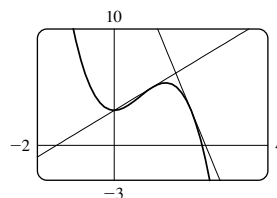
3. (a) 2 (b)  $y = 2x + 1$  (c)



5.  $y = -8x + 12$  7.  $y = \frac{1}{2}x + \frac{1}{2}$

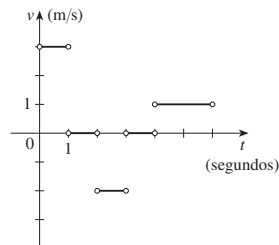
9. (a)  $8a - 6a^2$  (b)  $y = 2x + 3, y = -8x + 19$

- (c)



11. (a) Direita:  $0 < t < 1$  e  $4 < t < 6$ ; esquerda:  $2 < t < 3$ ; está parada:  $1 < t < 2$  e  $3 < t < 4$

- (b)



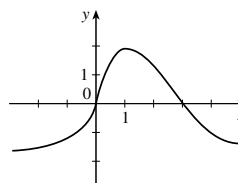
13.  $-9,6$  m/s

15.  $-2/a^3$  m/s;  $-2$  m/s;  $-\frac{1}{4}$  m/s;  $-\frac{2}{27}$  m/s

17.  $g'(0), 0, g'(4), g'(2), g'(-2)$

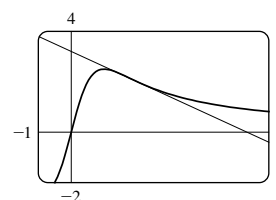
19.  $f(2) = 3; f'(2) = 4$

- 21.



23.  $y = 3x - 1$

25. (a)  $-\frac{3}{5}; y = -\frac{3}{5}x + \frac{16}{5}$  (b)



27.  $6a - 4$  29.  $\frac{5}{(a+3)^2}$  31.  $-\frac{1}{\sqrt{1-2a}}$

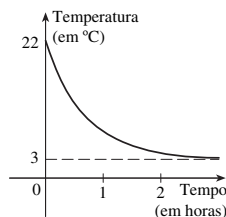
33.  $f(x) = x^{10}, a = 1$  ou  $f(x) = (1+x)^{10}, a = 0$

35.  $f(x) = 2^x, a = 5$

37.  $f(x) = \cos x, a = \pi$  ou  $f(x) = \cos(\pi + x), a = 0$

39. 1 m/s; 1 m/s

41. Maior (em módulo)



43. (a) (i) 0,82 (ii) 1,07 (iii) 1,38

(b) 1,23 milhão de passageiros por ano

45. (a) (i) \$ 20,25/unidade (ii) \$ 20,05/unidade

(b) \$ 20/unidades

47. (a) A taxa na qual o custo está variando por quilograma de ouro produzido; dólares por quilograma

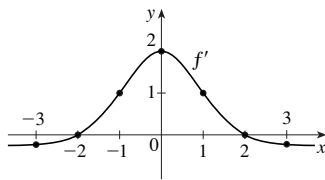
(b) Quando o 50º quilograma de ouro é produzido, o custo da produção é de \$ 36/kg

(c) Decresce a curto prazo; cresce a longo prazo

49. A taxa em que a temperatura está variando às 17h00;  $-1,25^\circ\text{C/h}$ 51. (a) A taxa em que a solubilidade do oxigênio varia com relação à temperatura da água;  $(\text{mg/L})/^\circ\text{C}$ (b)  $S'(16) \approx -0,25$ ; à medida que a temperatura aumenta após  $16^\circ\text{C}$ , a solubilidade do oxigênio está decrescendo a uma taxa de  $0,25 (\text{mg/L})/^\circ\text{C}$ .

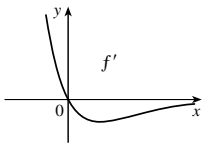
53. Não existe

## EXERCÍCIOS 2.8

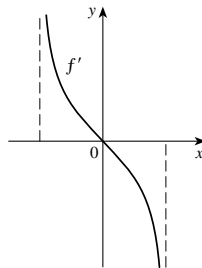
1. (a)  $-0,2$  (b) 0 (c) 1 (d) 2 (e) 1 (f) 0 (g)  $-0,2$ 

3. (a) II (b) IV (c) I (d) III

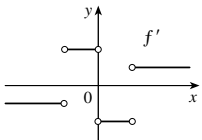
5.



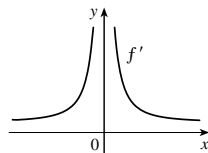
7.



9.

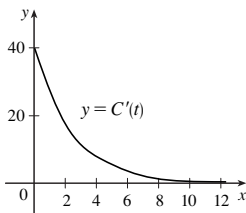


11.



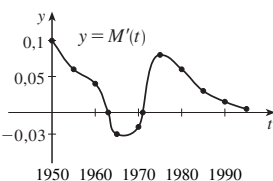
13. (a) A taxa instantânea de variação da porcentagem da capacidade total com relação ao tempo decorrido em horas

(b)



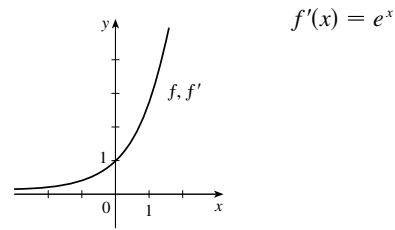
A taxa de variação da porcentagem da capacidade total está decrescendo e se aproximando a 0.

15.



1963 a 1971

17.

19. (a) 0, 1, 2, 4 (b)  $-1, -2, -4$  (c)  $f'(x) = 2x$ 21.  $f'(x) = \frac{1}{2}, \mathbb{R}, \mathbb{R}$  23.  $f'(t) = 5 - 18t, \mathbb{R}, \mathbb{R}$ 25.  $f'(x) = 3x^2 - 3, \mathbb{R}, \mathbb{R}$ 27.  $g'(x) = -\frac{1}{2\sqrt{9+x}}, (-\infty, 9], (-\infty, 9)$ 29.  $G'(t) = \frac{-7}{(3+t)^2}, (-\infty, -3) \cup (-3, \infty), (-\infty, -3) \cup (-3, \infty)$ 31.  $f'(x) = 4x^3, \mathbb{R}, \mathbb{R}$  33. (a)  $f'(x) = 4x^3 + 2$ 

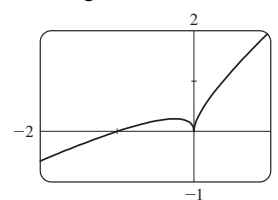
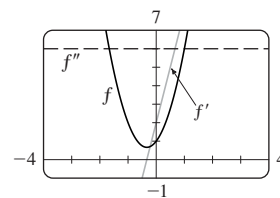
35. (a) A taxa em que o índice de desemprego está variando, em porcentagem de desempregados por ano

(b)

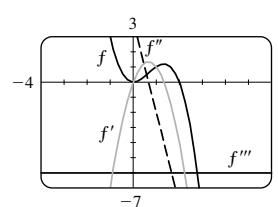
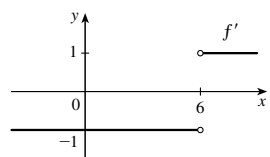
$t$	$U'(t)$	$t$	$U'(t)$
1995	-0,10	2000	0,10
1996	0,05	2001	0,15
1997	-0,05	2002	-0,35
1998	-0,75	2003	-0,45
1999	-0,85	2004	-0,60

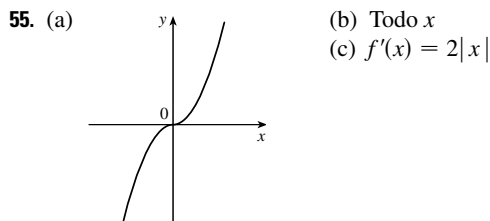
37.  $-4$  (canto); 0 (descontinuidade)39.  $-1$  (tangente vertical); 4 (canto)

41.

Derivável em  $-1$ ;  
não derivável em 043.  $a = f, b = f', c = f''$ 45.  $a = \text{aceleração}, b = \text{velocidade}, c = \text{posição}$ 47.  $6x + 2; 6$ 

49.

 $f'(x) = 4x - 3x^2,$  $f''(x) = 4 - 6x,$  $f'''(x) = -6,$  $f^{(4)}(x) = 0$ 51. (a)  $\frac{1}{3}a^{-2/3}$ 53.  $f'(x) = \begin{cases} -1 & \text{se } x < 6 \\ 1 & \text{se } x > 6 \end{cases}$ ou  $f'(x) = \frac{x-6}{|x-6|}$ 


 57.  $63^\circ$ 

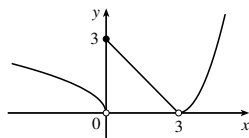
## CAPÍTULO 2 REVISÃO

### Teste Verdadeiro-Falso

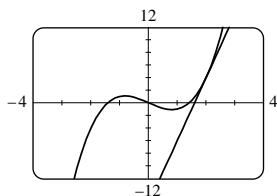
1. Falso 3. Verdadeiro 5. Falso 7. Verdadeiro 9. Verdadeiro  
11. Verdadeiro 13. Falso 15. Verdadeiro 17. Verdadeiro  
19. Falso 21. Falso 23. Verdadeiro

### Exercícios

1. (a) (i) 3 (ii) 0 (iii) Não existe (iv) 2  
(v)  $\infty$  (vi)  $-\infty$  (vii) 4 (viii)  $-1$   
(b)  $y = 4$ ,  $y = -1$  (c)  $x = 0$ ,  $x = 2$  (d)  $-3, 0, 2, 4$   
3. 1 5.  $\frac{3}{2}$  7. 3 9.  $\infty$  11.  $\frac{4}{7}$  13.  $\frac{1}{2}$   
15.  $-\infty$  17. 2 19.  $\pi/2$  21.  $x = 0$ ,  $y = 0$  23. 1  
29. (a) (i) 3 (ii) 0 (iii) Não existe (iv) 0 (v) 0 (vi) 0  
(b) Em 0 e 3 (c)

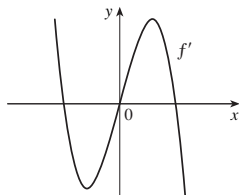

 31.  $\mathbb{R}$ 

35. (a)  $-8$  (b)  $y = -8x + 17$   
37. (a) (i) 3 m/s (ii) 2,75 m/s (iii) 2,625 m/s  
(iv) 2,525 m/s (b) 2,5 m/s  
39. (a) 10 (b)  $y = 10x - 16$   
(c)

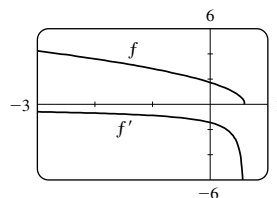


41. (a) A taxa em que o custo varia com relação à taxa de juros; dólares/(% ao ano)  
(b) À medida que a taxa de juros aumenta após 10%, o custo está aumentando a uma taxa de \$ 1 200/(% ao ano).  
(c) Sempre positivo

43.



45. (a)  $f'(x) = -\frac{5}{2}(3 - 5x)^{-1/2}$  (b)  $(-\infty, \frac{3}{5}]$ ,  $(-\infty, \frac{3}{5})$   
(c)



47.  $-4$  (descontinuidade),  $-1$  (canto),  $2$  (descontinuidade),  $5$  (tangente vertical)  
49. A taxa em que o valor do euro está variando no meio do ano de 2002 em termos de dólares americanos por ano; \$ 0,151/ano  
51. 0

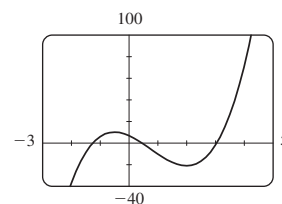
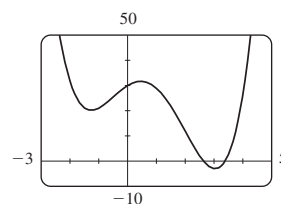
## PROBLEMAS QUENTES

1.  $\frac{2}{3}$  3.  $-4$  5. (a) Não existe (b) 1 7.  $a = \frac{1}{2} \pm \frac{1}{2}\sqrt{5}$   
9.  $\frac{3}{4}$  11. (b) Sim (c) Sim; não  
13. (a) 0 (b) 1 (c)  $f'(x) = x^2 + 1$

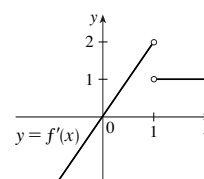
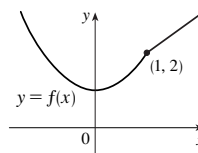
## CAPÍTULO 3

### EXERCÍCIOS 3.1

1. (a) Veja a Definição do Número  $e$   
(b) 0,99, 1,03;  $2,7 < e < 2,8$   
3.  $f'(x) = 0$  5.  $f'(x) = 5$  7.  $f'(x) = 3x^2 - 4$   
9.  $g'(x) = 2x - 6x^2$  11.  $y' = -\frac{2}{5}x^{-7/5}$  13.  $A'(s) = 60/s^6$   
15.  $R'(a) = 18a + 6$  17.  $S'(p) = \frac{1}{2}p^{-1/2} - 1$   
19.  $y' = 3e^x - \frac{4}{3}x^{-4/3}$  21.  $h'(u) = 3Au^2 + 2Bu + C$   
23.  $y' = \frac{3}{2}\sqrt{x} + \frac{2}{\sqrt{x}} - \frac{3}{2x\sqrt{x}}$  25.  $j'(x) = 2,4x^{1,4}$   
27.  $H'(x) = 3x^2 + 3 - 3x^{-2} - 3x^{-4}$   
29.  $u' = \frac{1}{5}t^{-4/5} + 10t^{3/2}$   
31.  $z' = -10A/y^{11} + Be^y$  33.  $y = \frac{1}{4}x + \frac{3}{4}$   
35. Tangente:  $y = 2x + 2$ ; normal:  $y = -\frac{1}{2}x + 2$   
37.  $y = 3x - 1$  39.  $f'(x) = 4x^3 - 6x^2 + 2x$   
41. (a) (c)  $4x^3 - 9x^2 - 12x + 7$

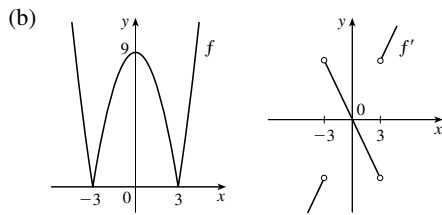


43.  $f'(x) = 100x^9 - 25x^4 + 1$ ;  $f''(x) = 900x^8 + 100x^3$   
45.  $f'(x) = 2 - \frac{15}{4}x^{-1/4}$ ,  $f''(x) = \frac{15}{16}x^{-5/4}$   
47. (a)  $v(t) = 3t^2 - 3$ ,  $a(t) = 6t$  (b) 12 m/s<sup>2</sup>  
(c)  $a(1) = 6$  m/s<sup>2</sup>  
49. (a)  $V = 5,3/P$   
(b)  $-0,00212$ ; taxa instantânea de variação do volume com relação à pressão em 25 °C; m<sup>3</sup>/kPa  
51.  $(-2, 21)$ ,  $(1, -6)$   
55.  $y = 12x - 15$ ,  $y = 12x + 17$  57.  $y = \frac{1}{3}x - \frac{1}{3}$   
59.  $(\pm 2, 4)$  63.  $P(x) = x^2 - x + 3$   
65.  $y = \frac{3}{16}x^3 - \frac{9}{4}x + 3$   
67. Não



69. (a) Não derivável em 3 ou  $-3$

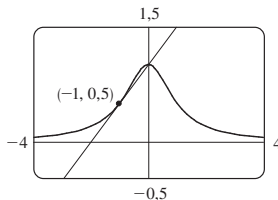
$$f'(x) = \begin{cases} 2x & \text{se } |x| > 3 \\ -2x & \text{se } |x| < 3 \end{cases}$$



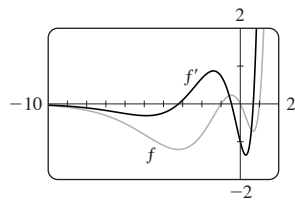
71.  $y = 2x^2 - x$     73.  $a = -\frac{1}{2}, b = 2$     75.  $m = 4, b = -4$   
 77. 1 000    79. 3; 1

## EXERCÍCIOS 3.2

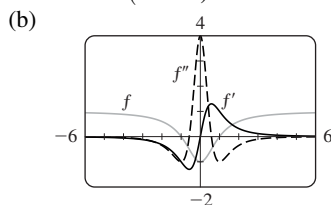
1.  $1 - 2x + 6x^2 - 8x^3$     3.  $f'(x) = e^x(x^3 + 3x^2 + 2x + 2)$   
 5.  $y' = (x - 2)e^x/x^3$     7.  $g'(x) = 5/(2x + 1)^2$   
 9.  $H'(u) = 2u - 1$     11.  $F'(y) = 5 + \frac{14}{y^2} + \frac{9}{y^4}$   
 13.  $y' = \frac{x^2(3 - x^2)}{(1 - x^2)^2}$     15.  $y' = \frac{2t(-t^4 - 4t^2 + 7)}{(t^4 - 3t^2 + 1)^2}$   
 17.  $y' = e^p(1 + \frac{3}{2}\sqrt{p} - p + p\sqrt{p})$     19.  $y' = 2v - 1/\sqrt{v}$   
 21.  $f'(t) = \frac{4 + t^{1/2}}{(2 + \sqrt{t})^2}$     23.  $f'(x) = \frac{-ACe^x}{(B + Ce^x)^2}$   
 25.  $f'(x) = \frac{2cx}{(x^2 + c)^2}$   
 27.  $(x^4 + 4x^3)e^x; (x^4 + 8x^3 + 12x^2)e^x$   
 29.  $\frac{2x^2 + 2x}{(1 + 2x)^2}; \frac{2}{(1 + 2x)^3}$     31.  $y = \frac{2}{3}x - \frac{2}{3}$   
 33.  $y = 2x; y = -\frac{1}{2}x$   
 35. (a)  $y = \frac{1}{2}x + 1$     (b)



37. (a)  $e^x(x^3 + 3x^2 - x - 1)$     (b)



39.  $f'(x) = \frac{4x}{(x^2 + 1)^2}; f''(x) = \frac{4(1 - 3x^2)}{(x^2 + 1)^2}$



41.  $\frac{1}{4}$     43. (a) -16    (b)  $-\frac{20}{9}$     (c) 20    45. 7  
 47.  $y = -2x + 18$   
 49. (a) 0    (b)  $-\frac{2}{3}$

51. (a)  $y' = xg'(x) + g(x)$     (b)  $y' = \frac{g(x) - xg'(x)}{[g(x)]^2}$   
 (c)  $y' = \frac{xg'(x) - g(x)}{x^2}$

53. Dois,  $(-2 \pm \sqrt{3}, \frac{1}{2}(1 \mp \sqrt{3}))$

55. 1    57. \$ 1,627 bilhão/ano    59.  $3e^{3x}$   
 61.  $f'(x) = (x^2 + 2x)e^x, f''(x) = (x^2 + 4x + 2)e^x,$   
 $f'''(x) = (x^2 + 6x + 6)e^x, f^{(4)}(x) = (x^2 + 8x + 12)e^x,$   
 $f^{(5)}(x) = (x^2 + 10x + 20)e^x, f^{(n)}(x) = [x^2 + 2nx + n(n - 1)]e^x$

## EXERCÍCIOS 3.3

1.  $f'(x) = 6x + 2 \sin x$     3.  $f'(x) = \cos x - \frac{1}{2} \operatorname{cosec}^2 x$   
 5.  $g'(t) = 3t^2 \cos t - t^3 \sin t$   
 7.  $h'(\theta) = -\operatorname{cosec} \theta \cotg \theta + e^\theta (\cotg \theta - \operatorname{cosec}^2 \theta)$

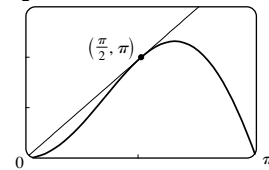
9.  $y' = \frac{2 - \operatorname{tg} x + x \sec^2 x}{(2 - \operatorname{tg} x)^2}$     11.  $f'(\theta) = \frac{\sec \theta \operatorname{tg} \theta}{(1 + \sec \theta)^2}$

13.  $y' = \frac{(t^2 + t) \cos t + \sin t}{(1 + t)^2}$

15.  $f'(x) = e^x \operatorname{cosec} x (-x \cotg x + x + 1)$

21.  $y = 2\sqrt{3}x - \frac{2}{3}\sqrt{3}\pi + 2$     23.  $y = x - \pi - 1$

25. (a)  $y = 2x$     (b)  $\frac{3\pi}{2}$



27. (a)  $\sec x \operatorname{tg} x - 1$   
 29.  $\theta \cos \theta + \sin \theta; 2 \cos \theta - \theta \sin \theta$   
 31. (a)  $f'(x) = (1 + \operatorname{tg} x)/\sec x$     (b)  $f'(x) = \cos x + \sin x$   
 33.  $(2n + 1)\pi \pm \frac{1}{3}\pi, n$  um inteiro  
 35. (a)  $v(t) = 8 \cos t, a(t) = -8 \sin t$   
 (b)  $4\sqrt{3}, -4, -4\sqrt{3}$ ; para a esquerda  
 37. 3 m/rad    39. 3    41. 3    43.  $-\frac{3}{4}$   
 45.  $\frac{1}{2}$     47.  $-\sqrt{2}$     49.  $-\cos x$     51.  $A = -\frac{3}{10}, B = -\frac{1}{10}$

53. (a)  $\sec^2 x = \frac{1}{\cos^2 x}$     (b)  $\sec x \operatorname{tg} x = \frac{\sin x}{\cos^2 x}$

(c)  $\cos x - \sin x = \frac{\cotg x - 1}{\operatorname{cosec} x}$

55. 1

## EXERCÍCIOS 3.4

1.  $4 \cos 4x$     3.  $-20x(1 - x^2)^9$     5.  $e^{\sqrt{x}}/(2\sqrt{x})$   
 7.  $F'(x) = 10x(x^4 + 3x^2 - 2)^4(2x^2 + 3)$

9.  $F'(x) = \frac{2 + 3x^2}{4(1 + 2x + x^3)^{3/4}}$     11.  $g'(t) = -\frac{12t^3}{(t^4 + 1)^4}$

13.  $y' = -3x^2 \sin(a^3 + x^3)$     15.  $y' = e^{-kx}(-kx + 1)$

17.  $f'(x) = (2x + 3)^3(x^2 + x + 1)^4(28x^2 - 12x - 7)$

19.  $h'(t) = \frac{2}{3}(t + 1)^{-1/3}(2t^2 - 1)^2(20t^2 + 18t - 1)$

21.  $y' = \frac{-12x(x^2 + 1)^2}{(x^2 - 1)^4}$     23.  $y' = \frac{3e^{3x}}{\sqrt{1 + 2e^{3x}}}$

25.  $y' = 5^{-1/x}(\ln 5)/x^2$     27.  $y' = (r^2 + 1)^{-3/2}$

29.  $F'(t) = e^t \sin 2t(2t \cos 2t + \sin 2t)$

31.  $y' = 2 \cos(\operatorname{tg} 2x) \sec^2(2x)$     33.  $y' = 2^{\sin \pi x}(\pi \ln 2) \cos \pi x$

35.  $y' = \frac{4e^{2x}}{(1 + e^{2x})^2} \sin \frac{1 - e^{2x}}{1 + e^{2x}}$

37.  $y' = -2 \cos \theta \cotg(\sin \theta) \operatorname{cosec}^2(\sin \theta)$

39.  $f'(t) = \sec^2(e^t)e^t + e^{\operatorname{tg} t} \sec^2 t$

41.  $f'(t) = 4 \sin(e^{\sin^2 t}) \cos(e^{\sin^2 t}) e^{\sin^2 t} \sin t \cos t$

43.  $g'(x) = 2r^2 p(\ln a)(2ra^{rx} + n)^{p-1} a^{rx}$

$$45. y' = \frac{-\pi \cos(\operatorname{tg} \pi x) \sec^2(\pi x) \operatorname{sen} \sqrt{\operatorname{sen}(\operatorname{tg} \pi x)}}{2\sqrt{\operatorname{sen}(\operatorname{tg} \pi x)}}$$

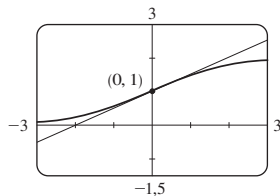
$$47. y' = -2x \operatorname{sen}(x^2); y'' = -4x^2 \cos(x^2) - 2 \operatorname{sen}(x^2)$$

$$49. e^{\alpha x}(\beta \cos \beta x + \alpha \operatorname{sen} \beta x);$$

$$e^{\alpha x}[(\alpha^2 - \beta^2) \operatorname{sen} \beta x + 2\alpha\beta \cos \beta x]$$

$$51. y = 20x + 1 \quad 53. y = -x + \pi$$

$$55. (a) y = \frac{1}{2}x + 1 \quad (b)$$



$$57. (a) f'(x) = \frac{2 - 2x^2}{\sqrt{2 - x^2}}$$

$$59. ((\pi/2) + 2n\pi, 3), ((3\pi/2) + 2n\pi, -1), n \text{ um inteiro}$$

$$61. 24 \quad 63. (a) 30 \quad (b) 36$$

$$65. (a) \frac{3}{4} \quad (b) \text{ Não existe} \quad (c) -2$$

$$67. -\frac{1}{6}\sqrt{2}$$

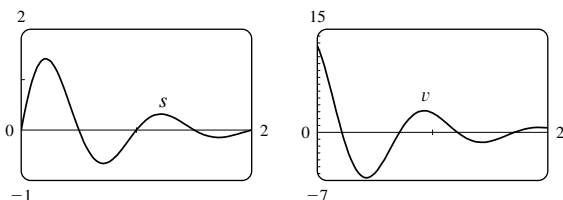
$$69. (a) F'(x) = e^x f'(e^x) \quad (b) G'(x) = e^{f(x)} f'(x)$$

$$71. 120 \quad 73. 96$$

$$77. -2^{50} \cos 2x \quad 79. v(t) = \frac{5}{2}\pi \cos(10\pi t) \text{ cm/s}$$

$$81. (a) \frac{dB}{dt} = \frac{7\pi}{54} \cos \frac{2\pi t}{5.4} \quad (b) 0,16$$

$$83. v(t) = 2e^{-1.5t}(2\pi \cos 2\pi t - 1,5 \operatorname{sen} 2\pi t)$$



85.  $dv/dt$  é a taxa de variação da velocidade com relação ao tempo;  
 $dv/ds$  é a taxa de variação da velocidade com relação ao deslocamento

$$87. (a) Q = ab^t \text{ onde } a \approx 100,01244 \text{ e } b \approx 0,000045146$$

$$(b) -670,63 \mu A$$

$$89. (b) \text{ A forma fatorada} \quad 93. (b) -n \cos^{n-1} x \operatorname{sen}[(n+1)x]$$

### EXERCÍCIOS 3.5

$$1. (a) y' = -(y+2+6x)/x$$

$$(b) y = (4/x) - 2 - 3x, y' = -(4/x^2) - 3$$

$$3. (a) y' = -y^2/x^2 \quad (b) y = x/(x-1), y' = -1/(x-1)^2$$

$$5. y' = -\frac{x^2}{y^2} \quad 7. y' = \frac{2x+y}{2y-x}$$

$$9. y' = \frac{3y^2 - 5x^4 - 4x^3y}{x^4 + 3y^2 - 6xy} \quad 11. y' = \frac{-2xy^2 - \operatorname{sen} y}{2x^2y + x \cos y}$$

$$13. y' = \operatorname{tg} x \operatorname{tg} y \quad 15. y' = \frac{y(y - e^{x/y})}{y^2 - xe^{x/y}}$$

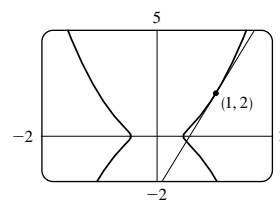
$$17. y' = \frac{1 + x^4y^2 + y^2 + x^4y^4 - 2xy}{x^2 - 2xy - 2x^3y^3}$$

$$19. y' = \frac{e^y \operatorname{sen} x + y \cos(xy)}{e^x \cos x - x \cos(xy)} \quad 21. -\frac{16}{13}$$

$$23. x' = \frac{-2x^4y + x^3 - 6xy^2}{4x^3y^2 - 3x^2y + 2y^3} \quad 25. y = \frac{1}{2}x$$

$$27. y = -x + 2 \quad 29. y = x + \frac{1}{2} \quad 31. y = -\frac{9}{13}x + \frac{40}{13}$$

$$33. (a) y = \frac{9}{2}x - \frac{5}{2} \quad (b)$$



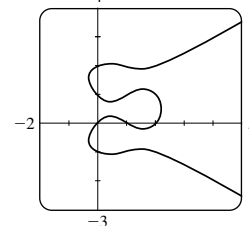
$$35. -81/y^3$$

$$41. (a)$$

$$37. -2x/y^5$$

$$39. 1/e^2$$

$$\text{Oito; } x \approx 0,42, 1,58$$



$$(b) y = -x + 1, y = \frac{1}{3}x + 2 \quad (c) 1 \mp \frac{1}{3}\sqrt{3}$$

$$43. (\pm \frac{5}{4}\sqrt{3}, \pm \frac{5}{4}) \quad 45. (x_0x/a^2) - (y_0y/b^2) = 1$$

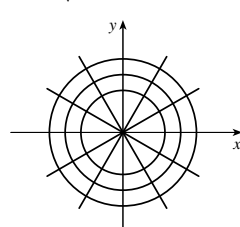
$$49. y' = \frac{1}{2\sqrt{x}(1+x)} \quad 51. y' = \frac{1}{\sqrt{-x^2-x}}$$

$$53. G'(x) = -1 - \frac{x \arccos x}{\sqrt{1-x^2}} \quad 55. h'(t) = 0$$

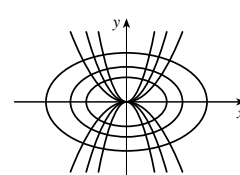
$$57. y' = \operatorname{sen}^{-1}x \quad 59. y' = \frac{\sqrt{a^2-b^2}}{a+b \cos x}$$

$$61. 1 - \frac{x \arcsen x}{\sqrt{1-x^2}}$$

$$65.$$



$$67.$$



$$71. (a) \frac{V^3(nb - V)}{PV^3 - n^2aV + 2n^3ab} \quad (b) -4,04 \text{ L/atm}$$

$$73. (\pm \sqrt{3}, 0) \quad 75. (-1, -1), (1, 1) \quad 77. (b) \frac{3}{2}$$

$$79. (a) 0 \quad (b) -\frac{1}{2}$$

### EXERCÍCIOS 3.6

1. A fórmula de derivação é mais simples.

$$3. f'(x) = \frac{\cos(\ln x)}{x} \quad 5. f'(x) = \frac{1}{5x^5(\ln x)^4}$$

$$7. f'(x) = \frac{3x^2}{(x^3+1) \ln 10} \quad 9. f'(x) = \frac{\operatorname{sen} x}{x} + \cos x \ln(5x)$$

$$11. g'(x) = \frac{2x^2-1}{x(x^2-1)} \quad 13. G'(y) = \frac{10}{2y+1} - \frac{y}{y^2+1}$$

$$15. F'(s) = \frac{1}{s \ln s} \quad 17. y' = \sec^2(\ln(ax+b)) \frac{a}{ax+b}$$

$$19. y' = \frac{-x}{1+x} \quad 21. y' = \frac{1}{\ln 10} + \log_{10} x$$

$$23. y' = x + 2x \ln(2x); y'' = 3 + 2 \ln(2x)$$

$$25. y' = \frac{1}{\sqrt{1+x^2}}; y'' = \frac{-x}{(1+x^2)^{3/2}}$$

$$27. f'(x) = \frac{2x-1-(x-1) \ln(x-1)}{(x-1)[1-\ln(x-1)]^2};$$

$$(1, 1+e) \cup (1+e, \infty)$$

29.  $f'(x) = \frac{2(x-1)}{x(x-2)}$ ;  $(-\infty, 0) \cup (2, \infty)$  31. 1

33.  $y = 3x - 9$  35.  $\cos x + 1/x$  37. 7

39.  $y' = (2x+1)^5(x^4-3)^6 \left( \frac{10}{2x+1} + \frac{24x^3}{x^4-3} \right)$

41.  $y' = \sqrt{\frac{x-1}{x^4+1}} \left( \frac{1}{2x-2} - \frac{2x^3}{x^4+1} \right)$

43.  $y' = x^x(1 + \ln x)$

45.  $y' = x^{\sin x} \left( \frac{\sin x}{x} + \cos x \ln x \right)$

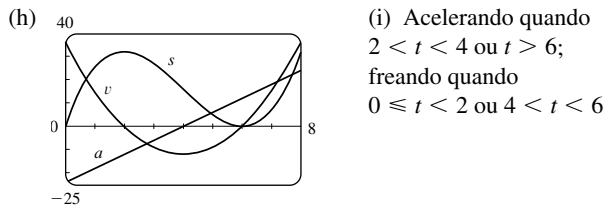
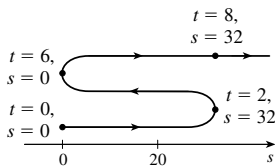
47.  $y' = (\cos x)^x (-x \tan x + \ln \cos x)$

49.  $y' = (\tan x)^{1/x} \left( \frac{\sec^2 x}{x \tan x} - \frac{\ln \tan x}{x^2} \right)$

51.  $y' = \frac{2x}{x^2 + y^2 - 2y}$  53.  $f^{(n)}(x) = \frac{(-1)^{n-1}(n-1)!}{(x-1)^n}$

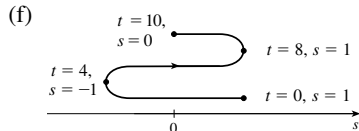
### EXERCÍCIOS 3.7

1. (a)  $3t^2 - 24t + 36$  (b)  $-9$  m/s (c)  $t = 2, 6$   
 (d)  $0 \leq t < 2, t > 6$  (e) 96 m  
 (f)  $t = 8, s = 32$  (g)  $6t - 24; -6$  m/s<sup>2</sup>

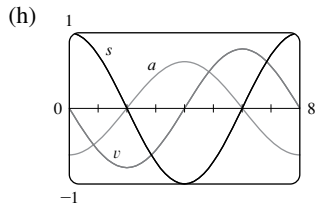


3. (a)  $-\frac{\pi}{4} \sin\left(\frac{\pi t}{4}\right)$  (b)  $-\frac{1}{8}\pi\sqrt{2}$  m/s (c)  $t = 0, 4, 8$

(d)  $4 < t < 8$  (e) 4 m



(g)  $-\frac{1}{16}\pi^2 \cos(\pi t/4); \frac{1}{32}\pi^2\sqrt{2}$  m/s<sup>2</sup>



- (i) Acelerando quando  $0 < t < 2, 4 < t < 6, 8 < t < 10$ ; freando quando  $2 < t < 4, 6 < t < 8$

5. (a) Acelerando quando  $0 < t < 1$  ou  $2 < t < 3$ ; freando quando  $1 < t < 2$

- (b) Acelerando quando  $1 < t < 2$  ou  $3 < t < 4$ ; freando quando  $0 < t < 1$  ou  $2 < t < 3$

7. (a) 4,9 m/s;  $-14,7$  m/s (b) Após 2,5 s (c)  $32\frac{5}{8}$  m

(d)  $\approx 5,08$  s (e)  $\approx -25,3$  m/s

9. (a) 7,56 m/s (b) 6,24 m/s;  $-6,24$  m/s

11. (a) 30 mm<sup>2</sup>/mm; a taxa em que a área está aumentando com relação ao comprimento da lateral quando  $x$  atinge 15 mm

(b)  $\Delta A \approx 2x \Delta x$

13. (a) (i)  $5\pi$  (ii)  $4,5\pi$  (iii)  $4,1\pi$

(b)  $4\pi$  (c)  $\Delta A \approx 2\pi r \Delta r$

15. (a)  $160\pi$  cm<sup>2</sup>/cm (b)  $320\pi$  cm<sup>2</sup>/cm (c)  $480\pi$  cm<sup>2</sup>/cm

A taxa aumenta à medida que o raio aumenta.

17. (a) 6 kg/m (b) 12 kg/m (c) 18 kg/m

Na extremidade direita; na extremidade esquerda

19. (a) 4,75 A (b) 5 A;  $t = \frac{2}{3}$  s

23. (a)  $dV/dP = -C/P^2$  (b) No início

25.  $400(3^t) \ln 3; \approx 6\,850$  bactérias/h

27. (a) 16 milhões/ano; 78,5 milhões/ano

(b)  $P(t) = at^3 + bt^2 + ct + d$ , onde  $a \approx 0,00129371$ ,

$b \approx -7,061422, c \approx 12,822,979, d \approx -7,743,770$

(c)  $P'(t) = 3at^2 + 2bt + c$

(d) 14,48 milhões/ano; 75,29 milhões/ano (menor)

(e) 81,62 milhões/ano

29. (a) 0,926 cm/s; 0,694 cm/s; 0

(b) 0;  $-92,6$  (cm/s)/cm;  $-185,2$  (cm/s)/cm

(c) Ao centro; na extremidade

31. (a)  $C'(x) = 12 - 0,2x + 0,0015x^2$

(b) \$ 32/ metro; o custo de produzir os 201<sup>os</sup> primeiros metros

(c) \$ 32,20

33. (a)  $[xp'(x) - p(x)]/x^2$ ; a produtividade média aumenta à medida que novos trabalhadores são contratados.

35.  $-0,2436$  K/min

37. (a) 0 e 0 (b)  $C = 0$

(c) (0, 0), (500, 50); é possível que as espécies coexistam.

### EXERCÍCIOS 3.8

1. Cerca de 235

3.  $100(4,2)^t$  (b)  $\approx 7,409$  (c)  $\approx 10,632$  bactérias/h

(d)  $(\ln 100)/(\ln 4,2) \approx 3,2$  h

5. (a) 1 508 milhões, 1 871 milhões (b) 2 161 milhões

(c) 3 972 milhões; guerras na primeira metade do século, expectativa de vida aumentada na segunda metade

7. (a)  $Ce^{-0,0005t}$  (b)  $-2\,000 \ln 0,9 \approx 211$  s

9. (a)  $100 \times 2^{-t/30}$  mg (b)  $\approx 9,92$  mg (c)  $\approx 199,3$  anos

11.  $\approx 2\,500$  anos 13. (a)  $\approx 58^\circ\text{C}$  (b)  $\approx 98$  min

15. (a)  $13,3^\circ\text{C}$  (b)  $\approx 67,74$  min

17. (a)  $\approx 64,5$  kPa (b)  $\approx 39,9$  kPa

19. (a) (i) \$3.828,84 (ii) \$3.840,25 (iii) \$3.850,08

(iv) \$3.851,61 (v) \$3.852,01 (vi) \$3.852,08

(b)  $dA/dt = 0,05A, A(0) = 3\,000$

### EXERCÍCIOS 3.9

1.  $dV/dt = 3x^2 dx/dt$  3. 48 cm<sup>2</sup>/s 5.  $3/(25\pi)$  m/min

7. (a) 1 (b) 25 9.  $-18$

11. (a) A altitude do avião é de 2 km e sua velocidade é de 800 km/h.

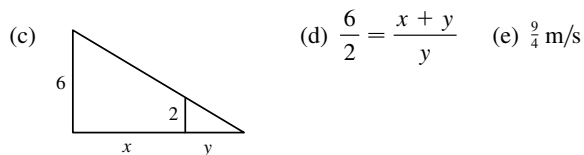
(b) A taxa na qual a distância entre o avião e a estação aumenta quando ele está a 3 km além da estação

(c)  (d)  $y^2 = x^2 + 4$

(e)  $\frac{800}{3}\sqrt{5}$  km/h

13. (a) A altura do poste (6 m), a altura do homem (2 m) e a velocidade do homem (1,5 m/s)

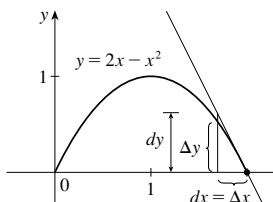
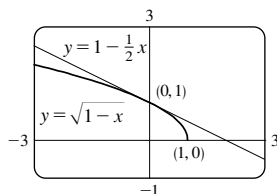
(b) A taxa em que a ponta da sombra do homem está se movendo quando ele está a 10 m do poste



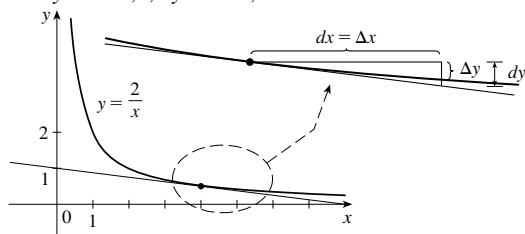
15. 78 km/h 17.  $8\,064/\sqrt{8\,334\,400} \approx 2,79 \text{ m/s}$   
 19.  $-1,6 \text{ cm/min}$  21.  $\frac{720}{13} \approx 55,4 \text{ km/h}$   
 23.  $(10\,000 + 800\,000\pi/9) \approx 2,89 \times 10^5 \text{ cm}^3/\text{min}$   
 25.  $\frac{10}{3} \text{ cm/min}$  27.  $4/(3\pi) \approx 0,42 \text{ m/min}$  29.  $0,3 \text{ m}^2/\text{s}$   
 31. 5 m 33.  $80 \text{ cm}^3/\text{min}$  35.  $\frac{107}{810} \approx 0,132 \Omega/\text{s}$   
 37.  $0,396 \text{ m/min}$  39. (a)  $120 \text{ m/s}$  (b)  $\approx 0,107 \text{ rad/s}$   
 41.  $\frac{10}{9}\pi \text{ km/min}$  43.  $1\,650/\sqrt{31} \approx 296 \text{ km/h}$   
 45.  $\frac{7}{4}\sqrt{15} \approx 6,78 \text{ m/s}$

### EXERCÍCIOS 3.10

1.  $L(x) = -10x - 6$  3.  $L(x) = \frac{1}{4}x + 1$   
 5.  $\sqrt{1-x} \approx 1 - \frac{1}{2}x$ ;  
 $\sqrt{0,9} \approx 0,95$ ,  
 $\sqrt{0,99} \approx 0,995$
7.  $-0,383 < x < 0,516$  9.  $-0,045 < x < 0,055$   
 11. (a)  $dy = 2x(x \cos 2x + \sin 2x) dx$  (b)  $dy = \frac{t}{1+t^2} dt$   
 13. (a)  $dy = \frac{\sec^2 \sqrt{t}}{2\sqrt{t}} dt$  (b)  $dy = \frac{-4v}{(1+v^2)^2} dv$   
 15. (a)  $dy = \frac{1}{10} e^{x/10} dx$  (b) 0,01  
 17. (a)  $dy = \frac{x}{\sqrt{3+x^2}} dx$  (b)  $-0,05$   
 19.  $\Delta y = 0,64$ ,  $dy = 0,8$



21.  $\Delta y = -0,1$ ,  $dy = -0,125$



23. 15,968 25. 10,003 27.  $1 - \pi/90 \approx 0,965$   
 33. (a)  $270 \text{ cm}^3$ , 0,01, 1% (b)  $36 \text{ cm}^2$ , 0,006, 0,6%  
 35. (a)  $84/\pi \approx 27 \text{ cm}^2$ ;  $\frac{1}{84} \approx 0,012 = 1,2\%$   
 (b)  $1\,764/\pi^2 \approx 179 \text{ cm}^3$ ;  $\frac{1}{56} \approx 0,018 = 1,8\%$   
 37. (a)  $2\pi rh \Delta r$  (b)  $\pi(\Delta r)^2 h$   
 43. (a) 4,8, 5,2 (b) Muito grande

### EXERCÍCIOS 3.11

1. (a) 0 (b) 1 3. (a)  $\frac{3}{4}$  (b)  $\frac{1}{2}(e^2 - e^{-2}) \approx 3,62686$   
 5. (a) 1 (b) 0  
 21.  $\text{sech } x = \frac{3}{5}$ ,  $\text{senh } x = \frac{4}{3}$ ,  $\text{cossech } x = \frac{3}{4}$ ,  $\text{tgh } x = \frac{4}{5}$ ,  $\text{cotgh } x = \frac{5}{4}$   
 23. (a) 1 (b) -1 (c)  $\infty$  (d)  $-\infty$  (e) 0 (f) 1  
 (g)  $\infty$  (h)  $-\infty$  (i) 0

31.  $f'(x) = x \cosh x$  33.  $h'(x) = \text{tgh } x$   
 35.  $y' = 3e^{\cosh 3x} \sinh 3x$   
 37.  $f'(t) = -2e^t \text{sech}^2(e^t) \text{tgh}(e^t)$

39.  $G'(x) = \frac{-2 \sinh x}{(1 + \cosh x)^2}$  41.  $y' = \frac{1}{2\sqrt{x}(x-1)}$

43.  $y' = \sinh^{-1}(x/3)$  45.  $y' = -\cossec x$

51. (a) 0,3572 (b)  $70,34^\circ$

53. (a) 164,50 m (b) 120 m; 164,13 m

55. (b)  $y = 2 \sinh 3x - 4 \cosh 3x$

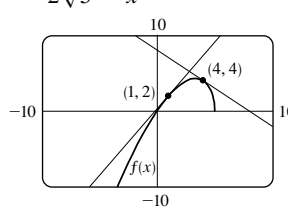
57.  $(\ln(1 + \sqrt{2}), \sqrt{2})$

## CAPÍTULO 3 REVISÃO

### Teste Verdadeiro-Falso

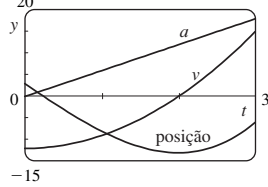
1. Verdadeiro 3. Verdadeiro 5. Falso 7. Falso 9. Verdadeiro  
 11. Verdadeiro 13. Verdadeiro 15. Verdadeiro

### Exercícios

1.  $6x(x^4 - 3x^2 + 5)^2(2x^2 - 3)$  3.  $\frac{1}{2\sqrt{x}} - \frac{4}{3\sqrt[3]{x^7}}$   
 5.  $x(\pi x \cos \pi x + 2 \sin \pi x)$   
 7.  $\frac{8t^3}{(t^4 + 1)^2}$  9.  $\frac{1 + \ln x}{x \ln x}$  11.  $\frac{\cos \sqrt{x} - \sqrt{x} \sin \sqrt{x}}{2\sqrt{x}}$   
 13.  $-\frac{e^{1/x}(1 + 2x)}{x^4}$  15.  $\frac{2xy - \cos y}{1 - x \sin y - x^2}$   
 17.  $\frac{1}{2\sqrt{\arctg x}(1 + x^2)}$  19.  $\frac{1 - t^2}{(1 + t^2)^2} \sec^2\left(\frac{t}{1 + t^2}\right)$   
 21.  $3^{x \ln x}(\ln 3)(1 + \ln x)$  23.  $-(x-1)^{-2}$   
 25.  $\frac{2x - y \cos(xy)}{x \cos(xy) + 1}$  27.  $\frac{2}{(1 + 2x) \ln 5}$   
 29.  $\cotg x - \sin x \cos x$  31.  $\frac{4x}{1 + 16x^2} + \text{tg}^{-1}(4x)$   
 33.  $5 \sec 5x$  35.  $-6x \cossec^2(3x^2 + 5)$   
 37.  $\cos(\text{tg} \sqrt{1 + x^3})(\sec^2 \sqrt{1 + x^3}) \frac{3x^2}{2\sqrt{1 + x^3}}$   
 39.  $2 \cos \theta \text{tg}(\sin \theta) \sec^2(\sin \theta)$   
 41.  $\frac{(x-2)^4(3x^2 - 55x - 52)}{2\sqrt{x+1}(x+3)^8}$  43.  $2x^2 \cosh(x^2) + \sinh(x^2)$   
 45.  $3 \text{tgh } 3x$  47.  $\frac{\cosh x}{\sqrt{\sinh^2 x - 1}}$   
 49.  $\frac{-3 \sin(e^{\sqrt{\text{tg } 3x}})e^{\sqrt{\text{tg } 3x}} \sec^2(3x)}{2\sqrt{\text{tg } 3x}}$  51.  $-\frac{4}{27}$  53.  $-5x^4/y^{11}$   
 57.  $y = 2\sqrt{3}x + 1 - \pi\sqrt{3}/3$  59.  $y = 2x + 1$   
 61.  $y = -x + 2$ ;  $y = x + 2$   
 63. (a)  $\frac{10 - 3x}{2\sqrt{5-x}}$  (b)  $y = \frac{7}{4}x + \frac{1}{4}$ ,  $y = -x + 8$   
 (c) 
65.  $(\pi/4, \sqrt{2})$ ,  $(5\pi/4, -\sqrt{2})$  69. (a) 2 (b) 44  
 71.  $2xg(x) + x^2g'(x)$  73.  $2g(x)g'(x)$  75.  $g'(e^x)e^x$   
 77.  $g'(x)/g(x)$  79.  $\frac{f'(x)[g(x)]^2 + g'(x)[f(x)]^2}{[f(x) + g(x)]^2}$   
 81.  $f'(g(\sin 4x))g'(\sin 4x)(\cos 4x)(4)$  83.  $(-3, 0)$   
 85.  $y = -\frac{2}{3}x^2 + \frac{14}{3}x$   
 87.  $v(t) = -Ae^{-ct}[c \cos(\omega t + \delta) + w \sin(\omega t + \delta)]$ ,  
 $a(t) = Ae^{-ct}[(c^2 - \omega^2) \cos(\omega t + \delta) + 2c\omega \sin(\omega t + \delta)]$

89. (a)  $v(t) = 3t^2 - 12$ ;  $a(t) = 6t$  (b)  $t > 2$ ;  $0 \leq t < 2$

(c) 23 (d)

(e)  $t > 2$ ;  $0 < t < 2$ 

91. 4 kg/m

93. (a)  $200(3,24)^t$  (b)  $\approx 22\,040$

(c)  $\approx 25\,910$  bactéria/h (d)  $(\ln 50)/(\ln 3,24) \approx 3,33$  h

95. (a)  $C_0 e^{-kt}$  (b)  $\approx 100$  h 97.  $\frac{4}{3}$  cm<sup>2</sup>/min

99.  $117/\sqrt{666} \approx 4,53$  m/s 101. 400 pés/h

103. (a)  $L(x) = 1 + x$ ;  $\sqrt[3]{1+3x} \approx 1 + x$ ;  $\sqrt[3]{1,03} \approx 1,01$

(b)  $-0,235 < x < 0,401$

105.  $12 + \frac{3}{2}\pi \approx 16,7$  cm<sup>2</sup> 107.  $\frac{1}{32}$  109.  $\frac{1}{4}$  111.  $\frac{1}{8}x^2$

## PROBLEMAS QUENTES

1.  $(\pm \frac{1}{2}\sqrt{3}/2, \frac{1}{4})$  5.  $3\sqrt{2}$  11.  $(0, \frac{5}{4})$

13. (a)  $4\pi\sqrt{3}/\sqrt{11}$  rad/s (b)  $40(\cos\theta + \sqrt{8 + \cos^2\theta})$  cm

(c)  $-480\pi \sin\theta (1 + \cos\theta/\sqrt{8 + \cos^2\theta})$  cm/s

17.  $x_T \in (3, \infty)$ ,  $y_T \in (2, \infty)$ ,  $x_N \in (0, \frac{5}{3})$ ,  $y_N \in (-\frac{5}{2}, 0)$

19. (b) (i)  $53^\circ$  (ou  $127^\circ$ ) (ii)  $63^\circ$  (ou  $117^\circ$ )

21. R aproxima-se do ponto médio do raio AO.

23.  $-\sin a$  25.  $2\sqrt{e}$  29.  $(1, -2)$ ,  $(-1, 0)$

31.  $\sqrt{29/58}$  33.  $2 + \frac{375}{128}\pi \approx 11,204$  cm<sup>3</sup>/min

## CAPÍTULO 4

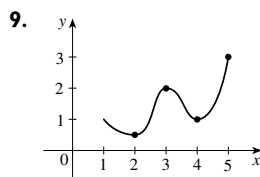
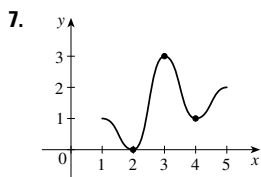
## EXERCÍCIOS 4.1

Abreviações: abs, absoluto; loc, local; max., máximo; min., mínimo

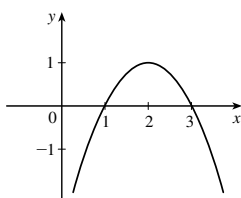
1. Min. abs: menor valor da função em todo o domínio da função;

Min. loc em c: menor valor da função quando  $x$  está próximo c

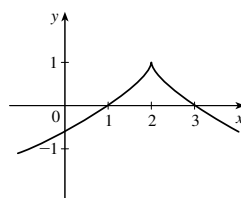
3. Max. abs em s, Min. abs em r, Max. loc em c, Min. loc em b e r, nem um max. nem um min. em a e d

5. Max. abs  $f(4) = 5$ , Max. loc  $f(4) = 5$  e  $f(6) = 4$ , Min. loc  $f(2) = 2$  e  $f(1) = f(5) = 3$ 

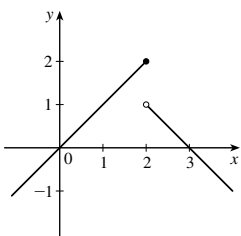
11. (a)



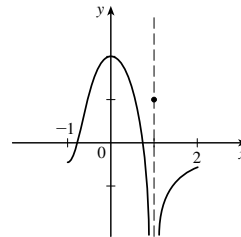
(b)



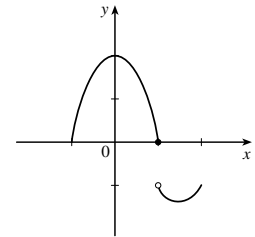
(c)



13. (a)



(b)



15. Max. abs  $f(3) = 4$  17. Max. abs  $f(1) = 1$

19. Min. abs  $f(0) = 0$

21. Max. abs  $f(\pi/2) = 1$ ; Min. abs  $f(-\pi/2) = -1$

23. Max. abs  $f(2) = \ln 2$  25. Max. abs  $f(0) = 1$

27. Max. abs  $f(3) = 2$  29.  $-\frac{2}{5}$  31.  $-2, 3$  33. 0

35. 0, 2 37.  $0, \frac{4}{9}$  39.  $0, \frac{8}{9}, 4$  41.  $n/\pi$  ( $n$  um inteiro)

43.  $0, \frac{2}{3}$  45. 10 47.  $f(0) = 5$ ,  $f(2) = -7$

49.  $f(-1) = 8$ ,  $f(2) = -19$  51.  $f(-2) = 33$ ,  $f(-2) = -31$

53.  $f(0,2) = 5,2$ ,  $f(1) = 2$  55.  $f(\sqrt{2}) = 2$ ,  $f(-1) = -\sqrt{3}$

57.  $f(\pi/6) = \frac{3}{2}\sqrt{3}$ ,  $f(\pi/2) = 0$

59.  $f(2) = 2/\sqrt{e}$ ,  $f(-1) = -1/\sqrt[8]{e}$

61.  $f(1) = \ln 3$ ,  $f(-\frac{1}{2}) = \ln \frac{3}{4}$

63.  $f\left(\frac{a}{a+b}\right) = \frac{a^a b^b}{(a+b)^{a+b}}$

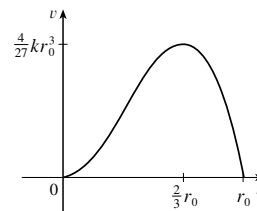
65. (a) 2, 19, 1, 81 (b)  $\frac{6}{25}\sqrt{\frac{3}{5}} + 2$ ,  $-\frac{6}{25}\sqrt{\frac{3}{5}} + 2$

67. (a) 0, 32, 0, 00 (b)  $\frac{3}{16}\sqrt{3}$ , 0 69.  $\approx 3,9665^\circ\text{C}$

71. Mais barato,  $t \approx 0,855$  (junho de 1994); mais caro,  $t \approx 4,618$  (março de 1998)

73. (a)  $r = \frac{2}{3}r_0$  (b)  $v = \frac{4}{27}kr_0^3$

(c)



## EXERCÍCIOS 4.2

1. 2 3.  $\frac{9}{4}$  5.  $f$  não é derivável em  $(-1, 1)$

7. 0, 3, 3, 6, 3 9. 1 11.  $-\frac{1}{2}\ln\left[\frac{1}{6}(1 - e^{-6})\right]$  13. 1

15.  $f$  não é contínua em 3 23. 16 25. Não 31. Não

## EXERCÍCIOS 4.3

Abreviações: cres., crescente; decres., decrescente; CC, côncava

para cima; CB, côncava para baixo; AH, assíntota horizontal;

AV, assíntota vertical; PI, ponto(s) de inflexão

1. (a) (1, 3), (4, 6) (b) (0, 1), (3, 4) (c) (0, 2)

(d) (2, 4), (4, 6) (e) (2, 3)

3. (a) Teste C/D (b) Teste da Concavidade

(c) Encontre os pontos em que a concavidade muda.

5. (a) Cres. em (1, 5); decres. em (0, 1) e (5, 6)

(b) Max. loc em  $x = 5$ , Min. loc em  $x = 1$

7. (a) 3, 5 (b) 2, 4, 6 (c) 1, 7

9. (a) Cres. em  $(-\infty, -3)$ ,  $(2, \infty)$ ; decres. em  $(-3, 2)$

(b) Max. loc  $f(-3) = 81$ ; Min. loc  $f(2) = -44$

(c) CC em  $(-\frac{1}{2}, \infty)$ ; CB em  $(-\infty, -\frac{1}{2})$ ; PI  $(-\frac{1}{2}, \frac{37}{2})$

11. (a) Cres. em  $(-1, 0)$ ,  $(1, \infty)$ ; decres. em  $(-\infty, -1)$ ,  $(0, 1)$

(b) Max. loc  $f(0) = 3$ ; Min. loc  $f(\pm 1) = 2$

(c) CC em  $(-\infty, -\sqrt{3}/3)$ ,  $(\sqrt{3}/3, \infty)$ ;