31. (a) Direção reversa   (b) Número de bobinas duplas

33. $3x - y + 3z = 3$ **35.** $\dfrac{\sqrt{3}}{2}x - \dfrac{1}{2}y + z = \dfrac{\pi}{3}$

37. $-x + 2z = 1$ **39.** $3\sqrt{14}$ **41.** $\sqrt{14}\pi$

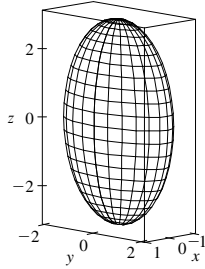**43.** $\frac{4}{15}(3^{5/2} - 2^{7/2} + 1)$ **45.** $(2\pi/3)(2\sqrt{2} - 1)$

47. $\frac{1}{2}\sqrt{21} + \frac{17}{4}[\ln(2 + \sqrt{21}) - \ln\sqrt{17}]$ **49.** 4

51. $A(S) \leqslant \sqrt{3}\pi R^2$ **53.** 13,9783

55. (a) 24,2055   (b) 24,2476

57. $\frac{45}{8}\sqrt{14} + \frac{15}{16}\ln[(11\sqrt{5} + 3\sqrt{70})/(3\sqrt{5} + \sqrt{70})]$

59. (b)

(c) $\int_0^{2\pi}\int_0^{\pi}\sqrt{36\,\text{sen}^4u\cos^2v + 9\,\text{sen}^4u\,\text{sen}^2v + 4\cos^2u\,\text{sen}^2u}\;du\,dv$

61. 4π **63.** $2a^2(\pi - 2)$

EXERCÍCIOS 16.7

1. 49,09   **3.** 900π **5.** $11\sqrt{14}$ **7.** $\frac{2}{3}(2\sqrt{2} - 1)$

9. $171\sqrt{14}$ **11.** $\sqrt{21}/3$ **13.** $364\sqrt{2}\pi/3$

15. $(\pi/60)(391\sqrt{17} + 1)$ **17.** 16π **19.** 12   **21.** 4

23. $\frac{713}{180}$ **25.** $-\frac{4}{3}\pi$ **27.** 0   **29.** 48   **31.** $2\pi + \frac{8}{3}$

33. 4,5822   **35.** 3,4895

37. $\iint_S \mathbf{F} \cdot d\mathbf{S} = \iint_D [P(\partial h/\partial x) - Q + R(\partial h/\partial z)]dA$, onde $D = $ projeção de S no plano xz

39. $(0, 0, a/2)$

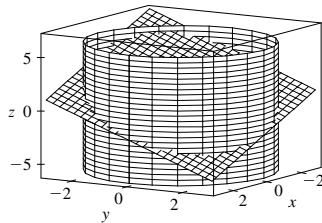**41.** (a) $I_z = \iint_S (x^2 + y^2)\rho(x, y, z)\,dS$ (b) $4\,329\sqrt{2}\pi/5$

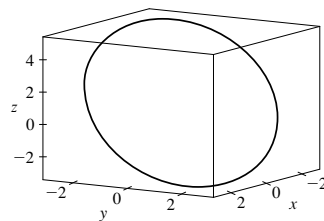**43.** 0 kg/s   **45.** $\frac{8}{3}\pi a^3 \varepsilon_0$ **47.** $1\,248\pi$

EXERCÍCIOS 16.8

3. 0   **5.** 0   **7.** -1 **9.** 80π

11. (a) $81\pi/2$ (b)

(c) $x = 3\cos t, y = 3\,\text{sen}\,t,$
$z = 1 - 3(\cos t + \text{sen}\,t),$
$0 \leqslant t \leqslant 2\pi$

17. 3

EXERCÍCIOS 16.9

5. $\frac{9}{2}$ **7.** $9\pi/2$ **9.** 0   **11.** $32\pi/3$ **13.** 2π

15. $341\sqrt{2}/60 + \frac{81}{20}\arcsin(\sqrt{3}/3)$

17. $13\pi/20$ **19.** Negativa em P_1, positiva em P_2

21. div $\mathbf{F} > 0$ em quadrantes I, II; div $\mathbf{F} < 0$ em quadrantes III, IV

CAPÍTULO 16 REVISÃO

Teste Verdadeiro-Falso

1. Falso   **3.** Verdadeiro   **5.** Falso

7. Falso   **9.** Verdadeiro   **11.** Verdadeiro

Exercícios

1. (a) Negativa   (b) Positiva   **3.** $6\sqrt{10}$ **5.** $\frac{1}{15}$

7. $\frac{110}{3}$ **9.** $\frac{11}{12} - 4/e$ **11.** $f(x, y) = e^y + xe^{xy}$ **13.** 0

17. -8π **25.** $\frac{1}{6}(27 - 5\sqrt{5})$ **27.** $(\pi/60)(391\sqrt{17} + 1)$

29. $-64\pi/3$ **33.** $-\frac{1}{2}$ **37.** -4 **39.** 21
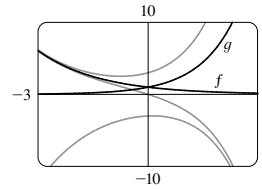
CAPÍTULO 17

EXERCÍCIOS 17.1

1. $y = c_1e^{3x} + c_2e^{-2x}$ **3.** $y = c_1\cos 4x + c_2\,\text{sen}\,4x$

5. $y = c_1e^{2x/3} + c_2\,xe^{2x/3}$ **7.** $y = c_1 + c_2e^{x/2}$

9. $y = e^{2x}(c_1\cos 3x + c_2\,\text{sen}\,3x)$

11. $y = c_1e^{(\sqrt{3}-1)t/2} + c_2e^{-(\sqrt{3}+1)t/2}$

13. $P = e^{-t}[c_1\cos(\frac{1}{10}t) + c_2\,\text{sen}(\frac{1}{10}t)]$

15.

Todas as soluções de tendem a 0 ou $\pm\infty$ à medida que $x \to \pm\infty$.

17. $y = 2e^{-3x/2} + e^{-x}$ **19.** $y = e^{-2x/3} + \frac{2}{3}xe^{-2x/3}$

21. $y = e^{3x}(2\cos x - 3\,\text{sen}\,x)$

23. $y = \frac{1}{7}e^{4x-4} - \frac{1}{7}e^{3-3x}$ **25.** $y = 5\cos 2x + 3\,\text{sen}\,2x$

27. $y = 2e^{-2x} - 2xe^{-2x}$ **29.** $y = \dfrac{e - 2}{e - 1} + \dfrac{e^x}{e - 1}$

31. Sem solução

33. (b) $\lambda = n^2\pi^2/L^2$, n um inteiro positivo; $y = C\,\text{sen}(n\pi x/L)$

35. (a) $b - a \neq n\pi$, n qualquer inteiro

(b) $b - a = n\pi$ e $\dfrac{c}{d} \neq e^{a-b}\dfrac{\cos a}{\cos b}$ a menos que $\cos b = 0$, então

$\dfrac{c}{d} \neq e^{a-b}\dfrac{\text{sen}\,a}{\text{sen}\,b}$

(c) $b - a = n\pi$ e $\dfrac{c}{d} = e^{a-b}\dfrac{\cos a}{\cos b}$ a menos que $\cos b = 0$, então

$\dfrac{c}{d} = e^{a-b}\dfrac{\text{sen}\,a}{\text{sen}\,b}$

EXERCÍCIOS 17.2

1. $y = c_1e^{3x} + c_2e^{-x} - \frac{7}{65}\cos 2x - \frac{4}{65}\,\text{sen}\,2x$

3. $y = c_1\cos 3x + c_2\,\text{sen}\,3x + \frac{1}{13}e^{-2x}$

5. $y = e^{2x}(c_1\cos x + c_2\,\text{sen}\,x) + \frac{1}{10}e^{-x}$

7. $y = \frac{3}{2}\cos x + \frac{11}{2}\,\text{sen}\,x + \frac{1}{2}e^x + x^3 - 6x$

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

11.
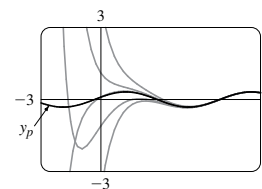
As soluções são assintóticas a $y_p = \frac{1}{10}\cos x + \frac{3}{10}\,\text{sen}\,x$ quando $x \to \infty$. Exceto por y_p, todas as soluções aproximam-se de ∞ ou $-\infty$ quando $x \to -\infty$.

13. $y_p = Ae^{2x} + (Bx^2 + Cx + D)\cos x + (Ex^2 + Fx + G)\,\text{sen}\,x$

15. $y_p = Axe^x + B\cos x + C\,\text{sen}\,x$

17. $y_p = xe^{-x}[(Ax^2 + Bx + C)\cos 3x + (Dx^2 + Ex + F)\,\text{sen}\,3x]$

19. $y = c_1\cos(\frac{1}{2}x) + c_2\,\text{sen}(\frac{1}{2}x) - \frac{1}{3}\cos x$