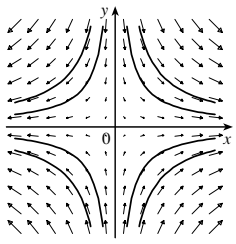
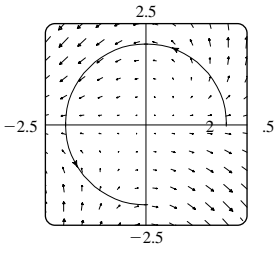
35. (a) 

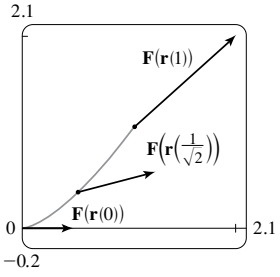
$y = C/x$ (b) $y = 1/x,\ x > 0$

EXERCÍCIOS 16.2

1. $\frac{1}{54}(145^{3/2} - 1)$ **3.** 1638,4 **5.** $\frac{243}{8}$ **7.** $\frac{5}{2}$
9. $\sqrt{5}\,\pi$ **11.** $\frac{1}{12}\sqrt{14}\,(e^6 - 1)$ **13.** $\frac{2}{5}(e - 1)$ **15.** $\frac{35}{3}$
17. (a) Positiva (b) Negativa **19.** 45
21. $\frac{6}{5} - \cos 1 - \operatorname{sen} 1$ **23.** 1,9633 **25.** 15,0074
27. $3\pi + \frac{2}{3}$



29. (a) $\frac{11}{8} - 1/e$ (b)



31. $\frac{172\,704}{5\,632\,705}\sqrt{2}(1 - e^{-14\pi})$ **33.** $2\pi k,\ (4/\pi, 0)$
35. (a) $\overline{x} = (1/m)\int_C x\rho(x, y, z)\,ds$,
$\overline{y} = (1/m)\int_C y\rho(x, y, z)\,ds$,
$\overline{z} = (1/m)\int_C z\rho(x, y, z)\,ds$, onde $m = \int_C \rho(x, y, z)\,ds$
(b) $(0, 0, 3\pi)$
37. $I_x = k\left(\frac{1}{2}\pi - \frac{4}{3}\right),\ I_y = k\left(\frac{1}{2}\pi - \frac{2}{3}\right)$ **39.** $2\pi^2$ **41.** $\frac{7}{3}$
43. (a) $2ma\,\mathbf{i} + 6mbt\,\mathbf{j},\ 0 \leq t \leq 1$ (b) $2ma^2 + \frac{9}{2}mb^2$
45. $\approx 1{,}67 \times 10^4$ pés-lb **47.** (b) Sim **51.** ≈ 22 J

EXERCÍCIOS 16.3

1. 40 **3.** $f(x, y) = x^2 - 3xy + 2y^2 - 8y + K$
5. Não conservativo **7.** $f(x, y) = ye^x + x \operatorname{sen} y + K$
9. $f(x, y) = x \ln y + x^2y^3 + K$
11. (b) 16 **13.** (a) $f(x, y) = \frac{1}{2}x^2y^2$ (b) 2
15. (a) $f(x, y, z) = xyz + z^2$ (b) 77
17. (a) $f(x, y, z) = ye^{xz}$ (b) 4 **19.** 2
21. Não importa qual curva é escolhida.
23. 30 **25.** Não **27.** Conservativo
31. (a) Sim (b) Sim (c) Sim
33. (a) Não (b) Sim (c) Sim

EXERCÍCIOS 16.4

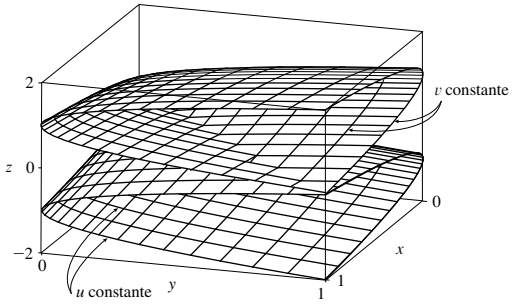
1. 8π **3.** $\frac{2}{3}$ **5.** 12 **7.** $\frac{1}{3}$ **9.** -24π **11.** $-\frac{16}{3}$
13. 4π **15.** $-8e + 48e^{-1}$ **17.** $-\frac{1}{12}$ **19.** 3π **21.** (c) $\frac{9}{2}$
23. $(4a/3\pi, 4a/3\pi)$ se a região é a porção do disco $x^2 + y^2 = a^2$ no primeiro quadrante
27. 0

EXERCÍCIOS 16.5

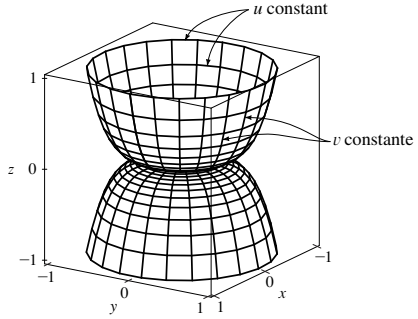
1. (a) $-x^2\,\mathbf{i} + 3xy\,\mathbf{j} - xz\,\mathbf{k}$ (b) yz
3. (a) $ze^x\,\mathbf{i} + (xye^z - yze^x)\,\mathbf{j} - xe^z\,\mathbf{k}$ (b) $y(e^z + e^x)$
5. (a) $\mathbf{0}$ (b) $2/\sqrt{x^2 + y^2 + z^2}$
7. (a) $\langle -e^y \cos z, -e^z \cos x, -e^x \cos y\rangle$
(b) $e^x \operatorname{sen} y + e^y \operatorname{sen} z + e^z \operatorname{sen} x$
9. (a) Negativa (b) rot $\mathbf{F} = \mathbf{0}$
11. (a) Zero (b) rot $\mathbf{F}$ pontos na direção negativa de z
13. $f(x, y, z) = xy^2z^3 + K$ **15.** Não conservativo
17. $f(x, y, z) = xe^{yz} + K$ **19.** Não

EXERCÍCIOS 16.6

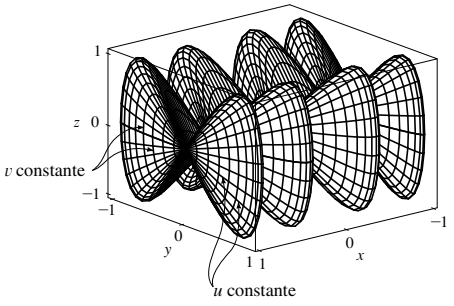
1. P: não; Q: sim
3. Plano por (0, 3, 1) contendo os vetores $\langle 1, 0, 4\rangle, \langle 1, -1, 5\rangle$
5. Paraboloide hiperbólico
7.



8.



11.



13. IV **15.** II **17.** III
19. $x = u,\ y = v - u,\ z = -v$
21. $y = y,\ z = z,\ x = \sqrt{1 + y^2 + \frac{1}{4}z^2}$
23. $x = 2 \operatorname{sen}\phi \cos\theta,\ y = 2 \operatorname{sen}\phi \operatorname{sen}\theta,$
$z = 2\cos\phi,\ 0 \leq \phi \leq \pi/4,\ 0 \leq \theta \leq 2\pi$
[ou $x = x,\ y = y,\ z = \sqrt{4 - x^2 - y^2},\ x^2 + y^2 \leq 2$]
25. $x = x,\ y = 4\cos\theta,\ z = 4 \operatorname{sen}\theta,\ 0 \leq x \leq 5,\ 0 \leq \theta \leq 2\pi$
29. $x = x,\ y = e^{-x}\cos\theta,$
$z = e^{-x} \operatorname{sen}\theta,\ 0 \leq x \leq 3,$
$0 \leq \theta \leq 2\pi$