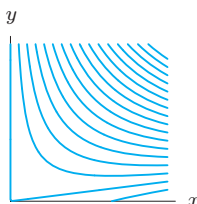


- 21 $\int_1^3 \int_{\frac{1}{2}(y-1)}^{-\frac{1}{2}(y-5)} f(x,y) dx dy$
- 23 $\frac{4}{15}(9\sqrt{3} - 4\sqrt{2} - 1) = 2.38176$
- 25 $32/9$
- 27 $13/6$
- 29 0
- 31 $2/3$
- 33 $(e - 1)/2$
- 35 $\frac{2}{9}(3\sqrt{3} - 2\sqrt{2})$

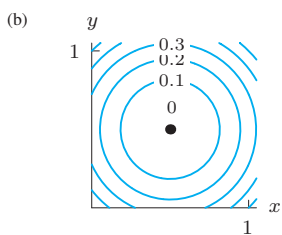
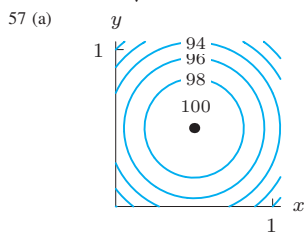
$f(x, y) = -3x^2 + 24xy:$



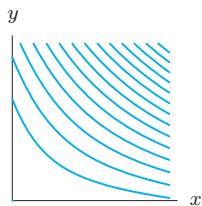
- 37 $\frac{1}{2}(e^2 - 1)$
- 39 (a) $8/3$
(b) $16/3$
- 41 (a) $\int_0^{1/2} \int_y^{1-y} f(x,y) dx dy$
 $\int_0^{1/2} \int_0^x f(x,y) dy dx$
 $\int_{1/2}^1 \int_0^{1-x} f(x,y) dy dx$
(b) $1/8$

- 43 15
- 45 $\int_{-5}^5 \int_{-\sqrt{25-y^2}}^{\sqrt{25-y^2}} (25 - x^2 - y^2) dx dy$
- 47 $\int_0^4 \int_{y-4}^{(4-y)/2} (4 - 2x - y) dx dy$
- 49 $1/3$
- 51 $16/3$
- 53 Volume = $1/(6abc)$

- 55 (a) Circles centered at $(1, 0)$
- (b) $\int_{-\sqrt{3}}^{\sqrt{3}} e^{-y^2} dy$
- (c) $\int_{-2}^2 \int_{-\sqrt{4-x^2}}^{\sqrt{4-x^2}} e^{-(x-1)^2 - y^2} dy dx$



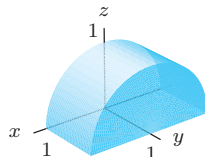
- 59 (a) $(4/3)a + b + (4/3)c = 20$
(b) $f(x, y) = x^2 + \frac{44}{3}xy + 3y^2:$



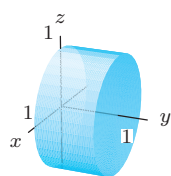
- 61 $k(a^3b + ab^3)/3$
- 63 Integrals not over same region
- 65 $\int_{-1}^1 \int_{-\sqrt{1-x^2}}^{\sqrt{1-x^2}} 2 dx dy$
- + 67 $\int_0^2 \int_0^{6-3y} 1 dx dy$
- 69 False
- 71 False
- 73 False
- 75 False

Section 16.3

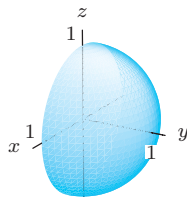
- 1 2
- 3 -8
- 5



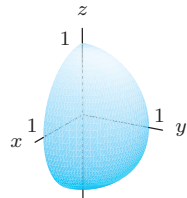
7



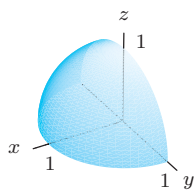
9



11



13



- 15 Positive
- 17 Positive
- 19 Zero
- 21 Positive
- 23 Zero
- 25 Positive
- 27 Positive
- 29 125

- 31 (a) $2 \int_0^{10} \int_0^1 \int_y^1 e^{-3x} dz dy dx$
Other answers are possible
(b) $(1 - e^{-30})/3$

33 $V = \int_0^1 \int_0^2 \int_{x+y}^{1+2x+2y} 1 dz dy dx$
Can reverse order x, y

35 $V = \int_0^1 \int_0^{1-x} \int_{6-3x-4y}^{6-2x-2y} 1 dz dy dx$
Can reverse order x, y

37 $V = \int_{-\sqrt{5}}^{\sqrt{5}} \int_{-\sqrt{5-x^2}}^{\sqrt{5-x^2}} \int_2^{\sqrt{9-x^2-y^2}} 1 dz dy dx$
Can reverse order x, y

39 $\int_0^1 \int_{-r}^r \int_0^{\sqrt{r^2-x^2}} f(x, y, z) dz dy dx$

41 $\int_{-r}^r \int_{-\sqrt{r^2-x^2}}^{\sqrt{r^2-x^2}} \int_0^{\sqrt{r^2-x^2-y^2}} f(x, y, z) dy dz dx$

43 $1/2$

45 162

47 1

49 29 gm

51 243

53 (a) $x + y + z = 1$

(b) $1/6$

55 $\int_0^2 \int_0^{1-\frac{z}{2}} \int_0^{2-2y-\frac{z}{2}} f(x, y, z) dx dy dz$

57 $\int_{-4}^4 \int_{-\sqrt{16-x^2}}^{\sqrt{16-x^2}} \int_3^{\sqrt{25-x^2-y^2}} dz dy dx$

59 $\int_{-1}^1 \int_{-\sqrt{1-x^2}}^{\sqrt{1-x^2}} \int_{-\sqrt{1-z^2}}^{\sqrt{1-z^2}} dy dz dx$

61 $\int_0^2 \int_0^{6y^2} \int_0^{\sqrt{12-3y^2}} f(x, y, z) dx dz dy$

63 4

65 $m = 2;$

$(\bar{x}, \bar{y}, \bar{z}) = (13/24, 13/24, 25/24)$

67 $5m/3$

71 Need same limits on innermost integral

73 $f(x, y, z) = z$

75 True

77 True

79 False

81 True

83 True

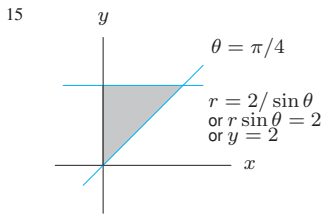
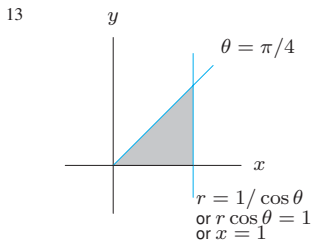
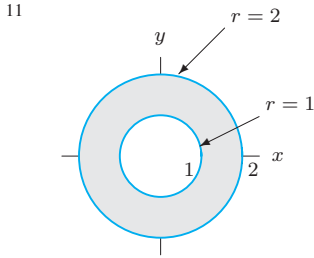
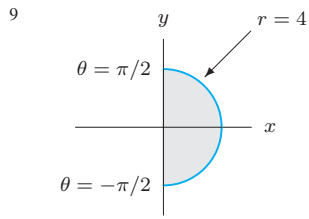
Section 16.4

1 $\int_0^{\pi/2} \int_0^{1/2} f(r, \theta) r dr d\theta$

3 $\int_{\pi/4}^{3\pi/4} \int_0^2 f(r, \theta) r dr d\theta$

5 $\int_1^5 \int_2^4 f(x, y) dy dx$

7 $\int_{-\pi}^{2\pi} \int_2^4 f(r \cos \theta, r \sin \theta) r dr d\theta$



17 $\pi(1 - \cos 4)$

19 $-2/3$

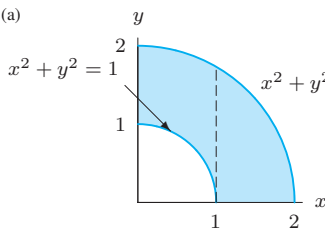
21 1.

23 (a) (i) $\int_0^{\pi/6} \int_0^{\pi} \int_0^5 \rho^2 \sin \phi d\rho d\phi d\theta;$
 $\frac{125\pi}{9}$

(ii) $\int_0^{\pi/6} \int_0^5 \int_0^{\sqrt{25-r^2}} r dz dr d\theta;$
 $2 \int_0^{\pi/6} \int_0^5 \int_0^{\sqrt{25-z^2}} r dr dz d\theta;$
 $\frac{125\pi}{9}$

(b) $1/12(4/3\pi 5^3)$

25 (a)



(b) $7/3$

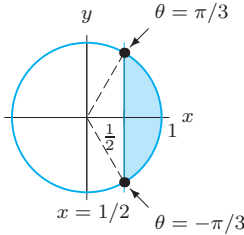
27 $32\pi(\sqrt{2} - 1)/3$

29 (a) $\int_0^{2\pi} \int_0^3 r/(r^2 + 1) dr d\theta$

(b) $\pi \ln 10$

31 $250\pi/3$ grams

33 (a)



(b) $(4\pi - 3\sqrt{3})/12$

35 (a) $\int_{-\sqrt{3}/2}^{\sqrt{3}/2} \int_{1-\sqrt{1-y^2}}^{\sqrt{1-y^2}} dx dy$

(b) $\int_0^1 \int_{-\arccos(r/2)}^{\arccos(r/2)} r d\theta dr$

37 Upper limit for inner integral $1/\cos \theta$

39 Quarter disk $0 \leq x \leq 1, 0 \leq y \leq \sqrt{1-x^2}$

41 (a), (c), (e)

Section 16.5

1 (a) is (IV); (b) is (II); (c) is (VII); (d) is (VI); (e) is (III); (f) is (V)

3 $z = \sqrt{1-r^2}$

5 $\phi = \pi/4$

7 $\rho = 4/\cos \phi$

9 $200\pi/3$

11 25π

13 $\int_0^1 \int_0^{2\pi} \int_0^4 f \cdot r dr d\theta dz$

15 $\int_0^{\pi} \int_0^{\pi} \int_2^3 f \cdot \rho^2 \sin \phi d\rho d\phi d\theta$

17 $\int_0^5 \int_0^2 \int_0^{x/5} f dz dy dx$

19 $\int_0^{2\pi} \int_0^K \int_{-\sqrt{K^2-r^2}}^{\sqrt{K^2-r^2}} r dz dr d\theta$

21 $\int_0^{2\pi} \int_0^2 \int_{2r}^4 f(r, \theta, z) r dz dr d\theta$

23 $\int_{-2}^2 \int_{-\sqrt{4-x^2}}^{\sqrt{4-x^2}} \int_{2\sqrt{x^2+y^2}}^4 h(x, y, z) dz dy dx$

25 (a) $\int_{-1/\sqrt{2}}^{1/\sqrt{2}} \int_{-\sqrt{(1/2)-x^2}}^{\sqrt{(1/2)-x^2}} \int_{\sqrt{x^2+y^2}}^{\sqrt{1-x^2-y^2}} dz dy dx$

(b) $\int_0^{2\pi} \int_0^{1/\sqrt{2}} \int_r^{\sqrt{1-r^2}} r dz dr d\theta$

(c) $\int_0^{2\pi} \int_0^{\pi/4} \int_0^1 \rho^2 \sin \phi d\rho d\phi d\theta$

27 (a) $\int_0^{2\pi} \int_0^{\sqrt{2}} \int_r^{\sqrt{4-r^2}} r dz dr d\theta$

(b) $\int_0^{2\pi} \int_0^{\pi/4} \int_0^2 \rho^2 \sin \phi d\rho d\phi d\theta$

(c) $\int_0^{2\pi} \int_0^{\pi/4} \int_0^1 \rho^2 \sin \phi d\rho d\phi d\theta$

29 $V = \int_0^{2\pi} \int_0^{\pi/3} \int_0^3 \rho^2 \sin \phi d\rho d\phi d\theta$

Order of integration can be altered; other coordinates can be used

31 $V = \int_0^{\pi} \int_{\sqrt{2}}^{\sqrt{3}} \int_5^{10} r dz dr d\theta;$

Order of integration can be altered; other coordinates can be used

33 $V = \int_0^{2\pi} \int_0^3 \int_1^{\sqrt{10-r^2}} r dz dr d\theta$

or $V = \int_0^{2\pi} \int_1^{\sqrt{10}} \int_0^{\sqrt{10-z^2}} r dr dz d\theta$ Order of integration can be altered; other coordinates can be used

35 (a) $\int_0^{2\pi} \int_0^{1/\sqrt{3}} \int_{\sqrt{3}r}^1 r dz dr d\theta$

(b) $\pi/9$

37 $16\pi(\sqrt{2} - 1)/(3\sqrt{2})$

39 $28\pi/15$

41 $\int_0^{2\pi} \int_0^{5/\sqrt{2}} \int_r^{5/\sqrt{2}} r dz dr d\theta = 125\pi/(6\sqrt{2}) = 46.28 \text{ cm}^3$

43 (a) Negative

(b) Zero

45 $pqr/6$

47 $\int_0^{2\pi} \int_0^{\pi/2} \int_a^b \rho^2 \sin \phi d\rho d\phi d\theta = 2\pi(b^3 - a^3)/3$

49 (a) $\int_0^{2\pi} \int_0^{\sqrt{2}} \int_0^{2-z} (2-z)r dz dr d\theta$

(b) $(\frac{16\sqrt{2}}{3} - \frac{4}{3})\pi$

51 $\int_0^{2\pi} \int_0^{\pi} \int_0^3 2\rho^3 \sin \phi d\rho d\phi d\theta$

53 $1/32$

55 (a) Mass =

$\int_0^{2\pi} \int_0^a \int_{-\sqrt{a^2-r^2}}^{\sqrt{a^2-r^2}} k|z|r dz dr d\theta$

(b) $\pi ka^4/2$

57 $3/4$

61 $3I = \frac{6}{5}a^2; I = \frac{2}{5}a^2$

63 $(q^2/8\pi\epsilon)((1/a) - (1/b))$

65 Mass = $\int_{-2}^2 \int_{-\sqrt{4-x^2}}^{\sqrt{4-x^2}} e^{-x-y} dz dy dx$ gm

67 $1/27$

69 $2\pi G\delta(H + R - \sqrt{R^2 + H^2})$

71 Total charge = $2\pi kR^2$

73 (c)

75 Limits of outer integral not constant

77 $\int_W \sqrt{x^2 + y^2 + z^2} dx dy dz;$
 W is unit ball $x^2 + y^2 + z^2 \leq 1$

Section 16.6

1 Is a joint density function

3 Not a joint density function

5 Is joint density function

7 0

9 1

11 $7/8$

13 $1/16$

15 (a) $20/27$

(b) $199/243$

17 (a) $k = 3/8$

(b) $15/32$

(c) $1/16$

19 $\int_{65}^{100} \int_{0.8}^1 f(x, y) dx dy$

23 $\int_{-\infty}^{\infty} \int_{-\infty}^{\infty} (p_1(x, y) + p_2(x, y)) dx dy = 2$