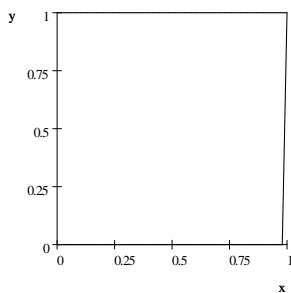


Chapter 4 Solutions

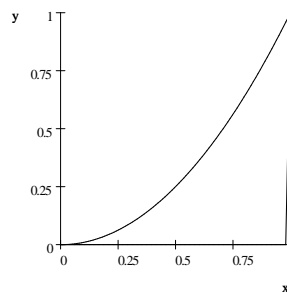
Section 4-1:

1. $\int_0^1 \int_0^1 (x + y) dy dx = 1$
3. $\int_0^2 \int_0^3 xy dx dy = 9$
5. $\int_0^1 \int_0^x (x^2 + y^2) dy dx = \frac{1}{3}$
7. $\int_0^\pi \int_0^\pi \cos(x) dy dx = 0$
9. $\int_0^{\pi/4} \int_0^{\sec(x)\tan(x)} dy dx = \sqrt{2} - 1$
11. $\int_0^\pi \int_0^x \sin(x) dy dx = \pi$
13. $\int_0^\pi \int_0^{\exp(x)} x dy dx = e^\pi \pi - e^\pi + 1$
15. $\int_0^2 \int_0^y \ln(y^2 + 1) dx dy = \frac{5}{2} \ln 5 - 2$
17. $\int_1^2 \int_0^{x^2} \frac{x}{x^2 + y^2} dy dx = 2 \arctan 2 - \frac{1}{2} \ln 5 - \frac{1}{4} \pi + \frac{1}{2} \ln 2$

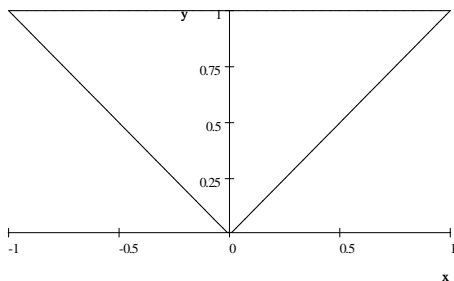
19. $\int_0^1 \int_0^1 (x^2 + y^2) dy dx = \frac{2}{3}$



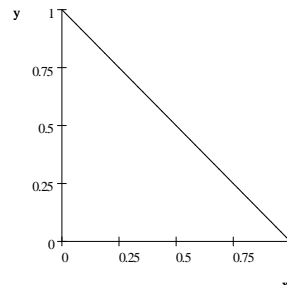
21. $\int_0^1 \int_0^{x^2} (3x + 2y) dy dx = \frac{19}{20}$



23. $\int_0^1 \int_{-y}^y xy dx dy = 0$



25. $\int_0^1 \int_0^{1-y} e^{x+y} dx dy = 1$



27. $\int_1^\infty \int_1^\infty \frac{1}{x^2 y^2} dy dx = 1$

29. $\int_1^\infty \int_0^{1/x^2} x^{-2} e^{-y} dy dx = 0.25318$

Section 4-2:

- | | | | |
|-----|--|-----|----------------|
| 1. | $V = \int_0^1 \int_0^1 xy dy dx = \frac{1}{4}$ | 9. | 0 |
| 3. | $V = \int_0^1 \int_y^1 (x^2 + y^2) dx dy = \frac{1}{3}$ | 11. | 2 |
| 5. | $V = \int_0^1 \int_0^1 (x + y - x^2 - y^2) dy dx = \frac{1}{3}$ | 13. | $\frac{1}{2}$ |
| 7. | $V = \int_0^\pi \int_0^x (1 - \sin(x)) dy dx = \frac{1}{2}\pi^2 - \pi$ | 15. | $2 \ln(2) - 1$ |
| 17. | $\int_0^{2\pi} \int_0^1 x \sin(y) dx dy = 0$ | 23. | 35 |
| 19. | $\int_0^3 \int_0^1 e^{x+y} dx dy = e^4 - e - e^3 + 1$ | 25. | 29 |
| 21. | $\int_0^\pi \int_{-\pi}^\pi \sin(x^2 y) dy dx = 0$ | 27. | 12 |
| | | 29. | 11 |

Section 4-3:

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|--------|--|--------------------------|-----------------------------------|---------------------------|--------------------------|
| 1. | $Mass = \int_0^1 \int_0^2 2 dy dx = 4 \text{ kg}$ | 7. | $\bar{x} = \frac{1}{2}$ | $\bar{y} = 1$ | |
| 3. | $Mass = \int_0^\pi \int_0^{\sin(x)} 2x dy dx = 2\pi \text{ kg}$ | 9. | $\bar{x} = \frac{\pi^2 - 4}{\pi}$ | $\bar{y} = \frac{\pi}{8}$ | |
| 5. | $Mass = \int_{-1}^1 \int_{x^2-1}^{1-x^2} (x^2 + y^2) dy dx = \frac{8}{7} \text{ kg}$ | 11. | $\bar{x} = 0$ | $\bar{y} = 0$ | |
| 13. | $\bar{x} = \frac{2}{3}$ | $\bar{y} = \frac{2}{3}$ | 19. | $\bar{X} = \frac{1}{2}$ | $\bar{Y} = 2.5$ |
| 15. | $\bar{x} = 0$ | $\bar{y} = \frac{1}{3}$ | 21. | $\bar{X} = \frac{7}{12}$ | $\bar{Y} = \frac{7}{12}$ |
| 17. | $\bar{x} = \frac{9}{20}$ | $\bar{y} = \frac{9}{20}$ | 23. | $\bar{X} = 1$ | $\bar{Y} = 5$ |
| 19-25: | Show | equal to 1 | 25. | $\bar{X} = 0$ | $\bar{Y} = 0$ |

Section 4-4:

- | | | | |
|-----|--|-----|----------------------|
| 1. | rectangle, Area=8 | 17. | 0 |
| 3. | parallelogram, Area=1 | 19. | $\frac{1}{\pi}$ |
| 5. | bounded by parabolas, Area = $\frac{8}{3}$ | 21. | $\frac{52}{3} \ln 2$ |
| 7. | ellipse, Area = 12π | 23. | 0.65066 2086 |
| 9. | $2 \ln 2$ | 25. | 1.48610 3812 |
| 11. | $\sin(e) - \sin 1$ | 27. | 3.854216320 |
| 13. | $\frac{1}{2} \sin 1$ | | |
| 15. | $\frac{1}{2} \ln 3$ | | |

Section 4-5:

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|-----|--|-----|--------------------|
| 1. | $\frac{1}{6}\pi$ | 17. | 25π |
| 3. | $\frac{1}{2}$ | 19. | $\frac{\pi}{4}$ |
| 5. | 1 | 21. | $\frac{\pi^5}{60}$ |
| 7. | $2\pi\left(9 - \frac{5}{3}\sqrt{5}\right)$ | 23. | $\frac{\pi}{6}$ |
| 9. | $1 - \frac{1}{2}\sqrt{2}$ | 25. | $\frac{10}{4}\pi$ |
| 11. | $\frac{\pi}{4}$ | 27. | $\frac{3\pi}{4}$ |
| 13. | $1 - \frac{1}{4}\pi$ | 29. | $\frac{\pi}{2}$ |
| 15. | $2 - \frac{\pi}{2}$ | | |

Section 4-6:

- | | | | |
|-----|------------------------|-----|---|
| 1. | 1 | 7. | $\frac{1}{2} kg$ |
| 3. | $\frac{1}{8}$ | 9. | $\frac{8}{15} kg$ |
| 5. | $\frac{1}{3}$ | 11. | $\frac{1}{3} kg$ |
| 13. | 2 coulombs | 19. | $\bar{x} = \frac{2}{3}$ $\bar{y} = \frac{2}{3}$ $\bar{z} = \frac{2}{9}$ |
| 15. | $\frac{1}{2}$ coulombs | 21. | $\bar{x} = \frac{5}{6}$ $\bar{y} = \frac{15}{32}$ $\bar{z} = \frac{1}{2}$ |
| 17. | $\frac{1}{3}$ coulombs | 23. | $\bar{x} = \frac{1}{2}$ $\bar{y} = \frac{19}{30}$ $\bar{z} = \frac{19}{20}$ |

Section 4-7:

- | | | | |
|-----|----------------------|-----|---|
| 1. | 2π | 15. | $8\pi^2$ |
| 3. | $\frac{7\pi}{6}$ | 17. | $\frac{162}{5}\pi$ |
| 5. | 0 | 19. | unit sphere, $V = \frac{4\pi}{3}$ |
| 7. | $\frac{1}{2}$ | 21. | ice cream cone, $V = \frac{\pi}{3}(2 - \sqrt{2})$ |
| 9. | $\frac{3321\pi}{16}$ | 23. | $V = \frac{\pi}{3}(2 - \sqrt{2})$ |
| 11. | 4π | 25. | $\frac{8\pi}{3}C$ |
| 13. | 0 | 27. | $\pi\rho_0$ |
| | | 29. | $4\pi\rho_0(2 - 5e^{-1})$ |