

## Answers to Homework Problems

- 15.2:** 18.  $\frac{\pi}{3}$  30.  $\frac{640}{3}$   
**15.3:** 16.  $\frac{1}{2}e^{16} - \frac{17}{2}$  18.  $\frac{23}{84}$  24.  $\frac{2336}{27}$  52.  $\frac{1}{2}(e - 1)$   
**15.7:** 12.  $\frac{1}{2}\pi^2 - 2$  14.  $\frac{3}{28}$  20.  $16\pi$  34.  $\int_0^1 \int_0^{1-x} \int_0^{1-x^2} f(x, y, z) dz dy dx$   
**15.8:** 10. (a)  $z = 6 - r(3 \cos \theta + 2 \sin \theta)$  (b)  $z^2 = 1 + r^2$  16.  $\frac{16}{3}\pi$   
 18.  $\frac{64}{3}\pi$  22.  $\frac{4}{3}\pi(8 - 3^{3/2})$  24.  $(-\frac{7}{6} + \frac{4}{3}\sqrt{2})\pi$  30.  $\frac{162}{5}\pi$   
**15.9:** 18.  $\frac{14\pi}{3}$   
 20.  $\int_0^{\pi/2} \int_{\pi/2}^{2\pi} \int_1^2 f(\rho \sin \phi \cos \theta, \rho \sin \phi \sin \theta, \rho \cos \phi) \rho^2 \sin \phi d\rho d\theta d\phi$   
 22.  $\frac{486}{5}\pi$  26. 0 36.  $\frac{1}{9}\pi a^3$  40. 0  
**15.10:** 8.  $\sim$  14.  $x = \sqrt{u/v}, y = \sqrt{uv}$  16. 192 18.  $\frac{4\pi}{\sqrt{3}}$  24.  $\frac{1}{4}(e^6 - 7)$   
 26.  $\frac{\pi}{24}(1 - \cos 1)$   
**16.1:** 4.  $\sim$  6.  $\sim$  22.  $3 \sec^2(3x - 4y)\mathbf{i} - 4 \sec^2(3x - 4y)\mathbf{j}$   
 24.  $\ln(y - 2z)\mathbf{i} + \frac{x}{y-2z}\mathbf{j} - \frac{2x}{y-2z}\mathbf{k}$  26.  $\frac{x}{\sqrt{x^2+y^2}}\mathbf{i} + \frac{y}{\sqrt{x^2+y^2}}\mathbf{j}$  36. (c)  $y = \frac{1}{2}x^2$   
**16.2:** 4.  $\frac{20}{9}(\sin 6 - 3 \cos 6 - \sin 3)$  8.  $\frac{83}{3}$  12.  $\sqrt{5}(\frac{8}{3}\pi^3 + 2\pi)$  14.  $\frac{722}{15}$  16. 2  
 20.  $\frac{17}{15}$  22. 0 50.  $\sim$   
**16.3:** 8. Yes 12. 171 16. (a)  $f(x, y, z) = xy^2z + x^2z^2 + C$  (b) 5  
 18. (a)  $f(x, y, z) = x \sin y + y \cos z + C$  (b)  $1 - \frac{\pi}{2}$  20. -2 30.  $\sim$   
**16.4:** 4.  $\frac{22}{105}$  8. 0 10.  $\frac{195}{2}\pi$  12.  $\frac{1}{2}\pi$  14.  $\frac{\pi}{4} - \frac{1}{2} \ln 2$  28. 12  
**16.5:** 6. (a)  $[\tan^{-1}(x/z) - e^{xy} \cos z]\mathbf{i} - \frac{yz}{x^2+z^2}\mathbf{j} + ye^{xy} \sin z\mathbf{k}$  (b)  $xe^{xy} \sin z - \frac{xy}{x^2+z^2}$   
 8. (a)  $\langle y/z^2, z/x^2, x/y^2 \rangle$  (b)  $\frac{1}{y} + \frac{1}{z} + \frac{1}{x}$  14. No 20. No 27.  $\sim$  29.  $\sim$   
 32.  $p = 3$  33.  $\sim$   
**16.6:** 20.  $x = 2u - 3v, y = -1 + u + 2v, z = 5 + 4u + 5v$  34.  $3x + 4y - 12z = -13$   
 40.  $4\sqrt{22}$  46.  $\frac{\pi}{6}(37\sqrt{37} - 1)$  50  $4\pi b(b - \sqrt{b^2 - a^2})$  62. 16 64. (c)  $4\pi^2 ab$   
**16.7:** 10. 4 18. 0 24.  $-\frac{1712}{15}\pi$  28.  $1 - e$  40.  $108\sqrt{2}\pi$  48.  $4\pi Kc$   
**16.8:** 6. 0 8.  $\frac{1}{24}$  14.  $8\pi$  16.  $\sim$  18.  $\pi$