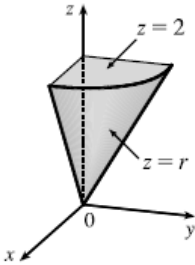


MAC2313 Review 3 Answer

1. (1) $\left(2, \frac{5\pi}{3}, -2\sqrt{3}\right)$ (2) $\left(4, \frac{5\pi}{3}, \frac{5\pi}{6}\right)$
2. (1) cylinder $x^2 + (y - 1)^2 = 1$ (2) hyperbolic paraboloid $z = x^2 - y^2$
3. (1) sphere $x^2 + y^2 + (z - 2)^2 = 4$ (2) cone $z^2 = x^2 + y^2$
4. (1) $E = \{ (r, \theta, z) \mid 0 \leq \theta \leq \pi, 0 \leq r \leq 2 \sin \theta, 0 \leq z \leq r^2 \}$



(2)

5. (1) $E = \{ (\rho, \theta, \phi) \mid 0 \leq \theta \leq \pi/2, 0 \leq \phi \leq \pi/6, 0 \leq \rho \leq 2 \}$
 (2) half of the cap ($y \geq 0$) of the sphere $x^2 + y^2 + z^2 = 4$ with thickness 1
6. (1) $\frac{4}{3}(19 - 5\sqrt{5})$ (2) $\frac{1}{2}(e - 1)$ (3) $\frac{1}{4}(1 - \cos(1))$ (4) $\frac{\ln(5)}{8}\pi$

7. $\int_{\pi/4}^{\pi/2} \int_0^{2 \cos \theta} r \, dr \, d\theta$

8. (1) $2 \left[\int_0^{\pi/3} \int_0^{1+\cos \theta} r \, dr \, d\theta + \int_{\pi/3}^{\pi/2} \int_0^{3 \cos \theta} r \, dr \, d\theta \right]$

(2) $\int_{\pi/4}^{\pi} \int_0^{2 \sin \theta} r \, dr \, d\theta - \int_{\pi/4}^{\pi/2} \int_0^{2 \cos \theta} r \, dr \, d\theta$

9. (1) $\int_0^{\pi/3} \int_0^3 r^4 \, dr \, d\theta$ (2) $\int_0^{\pi} \int_0^{2 \sin \theta} r^2 \, dr \, d\theta$

10. $V = \int_0^6 \int_0^{3-x/2} \int_0^{6-x-2y} dz \, dy \, dx$

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

$$12. (1) \int_{-\sqrt{2}}^{\sqrt{2}} \int_{-\sqrt{2-x^2}}^{\sqrt{2-x^2}} \int_{\sqrt{x^2+y^2}}^{\sqrt{4-x^2-y^2}} 3 dz dy dx$$

$$(2) \int_0^{2\pi} \int_0^{\pi/4} \int_0^2 3\rho^2 \sin \phi d\rho d\phi d\theta$$

$$(3) 8\pi(2 - \sqrt{2})$$

$$13. \int_0^{2\pi} \int_0^{\pi/4} \int_0^{\sec \phi} \rho^2 \sin \phi d\rho d\phi d\theta = \frac{\pi}{3}$$

$$14. \int_0^{\pi/2} \int_0^{2\cos \theta} \int_0^{r^2} f(r \cos \theta, r \sin \theta, z) r dz dr d\theta$$

$$15. 16/3$$

$$16. 2\pi$$

$$17. \int_0^\pi \int_{\cos \theta}^{2\cos \theta} \int_0^{3-r \sin \theta} r dz dr d\theta$$

$$18. 6 \sin(1)$$

$$19. 8\pi(4\sqrt{2} - 1)$$

$$20. V = \int_0^1 \int_0^{1-u} \int_0^{1-u-v} 8uvw dw dv du$$

$$21. \text{True; false; false; false; false; true}$$