19. 1st octant

$\theta \in [0, \frac{\pi}{2}]$

$z = 4 - x^2 - y^2 = 4 - r^2$

$z \in [0, 4-r^2]$

$r^2 = 4$

$r = 2$

$r \in [0, 2]$

$$\int_0^{\frac{\pi}{2}} \int_0^2 \int_0^{4-r^2} (x+y+z)\, r\, dz\, dr\, d\theta = \int_0^{\frac{\pi}{2}} \int_0^2 \int_0^{4-r^2} r^2\cos\theta + r^2\sin\theta + rz \, dz\, dr\, d\theta$$

$$= \int_0^{\frac{\pi}{2}} \int_0^2 \left[r^2 z(\cos\theta + \sin\theta) + \frac{1}{2} r z^2 \right]_0^{4-r^2} dr\, d\theta$$

$$= \int_0^{\frac{\pi}{2}} \int_0^2 r^2(4-r^2)(\cos\theta + \sin\theta) + \frac{1}{2} r (4-r^2)^2 \, dr\, d\theta$$

$$= \int_0^{\frac{\pi}{2}} \int_0^2 (4r^2 - r^4)(\cos\theta + \sin\theta) + 8r - 4r^3 + \frac{1}{2} r^5 \, dr\, d\theta$$

$$= \int_0^{\frac{\pi}{2}} \left[\left(\frac{4}{3} r^3 - \frac{1}{5} r^5 \right)(\cos\theta + \sin\theta) + 4r^2 - r^4 + \frac{1}{12} r^6 \right]_0^2 d\theta$$

$$= \int_0^{\frac{\pi}{2}} \frac{64}{15}(\cos\theta + \sin\theta) + \frac{16}{3} \, d\theta$$

$$= \frac{64}{15}(\sin\theta - \cos\theta) + \frac{16}{3}\theta \Big]_0^{\frac{\pi}{2}} = \frac{64}{15}(1) + \frac{16\pi}{6} + \frac{64}{15} + 0$$

$$= \boxed{\frac{128}{15} + \frac{8\pi}{3}}$$