19. contd

$$= \frac{3}{2}\int_0^{2\pi}(5-3\cos\theta)^2 \cdot 3\sin\theta \, d\theta = \frac{3}{2}\int_2^2 v^2 \, dv = 0 = S_1$$

$v = 5-3\cos\theta$

$dv = 3\sin\theta \, d\theta$

S_2. $x=0 \rightarrow \iint_{S_2} xz \, dS = \iint_{S_2} 0 \, dS = 0$

S_3. $D = \{(y,z) \mid y^2+z^2 \le 9\}$ $x = 5-y$ $\frac{dx}{dy} = -1$ $\frac{dx}{dz} = 0$

$r^2 \le 9$ $r \in [0,3]$ $\theta \in [0,2\pi]$ $dS = \sqrt{1+1+0}\,dA = \sqrt{2}\,dA$

$$\iint_{S_3} xz \, dS = \iint_{S_3} x(r\sin\theta)\sqrt{2}\,dA = \sqrt{2}\int_0^{2\pi}\int_0^3 (5-3\cos\theta)(r\sin\theta)\sqrt{2}\,r\,dr\,d\theta$$

$$= \int_0^{2\pi}\int_0^3 5\sqrt{2}\,r^2\sin\theta - \sqrt{2}\,r^3\cos\theta\sin\theta \, dr\,d\theta =$$

$$= \int_0^{2\pi}\int_0^3 5\sqrt{2}\,r^2\sin\theta\,dr\,d\theta - \int_0^{2\pi}\int_0^3 \sqrt{2}\,r^3\cos\theta\sin\theta\,dr\,d\theta$$

$$= 5\sqrt{2}\int_0^{2\pi}\sin\theta\,d\theta\int_0^3 r^2\,dr - \sqrt{2}\int_0^{2\pi}\cos\theta\sin\theta\,d\theta\int_0^3 r^3\,dr$$

$$= 0 - 0 = 0$$

$$\iint_S xz\,dS = \iint_{S_1} xz\,dS_1 + \iint_{S_2} xz\,dS_2 + \iint_{S_3} xz\,dS_3 = 0+0+0 = \boxed{0}$$