(17) $\iint_S (x^2 z + y^2 z)\, dS \quad x^2+y^2+z^2=4 \quad z \geq 0$

$x^2+y^2=4$

$r^2=4 \quad r \in [0,2] \quad \theta \in [0,2\pi]$

$z = \sqrt{4-x^2-y^2}$

$\frac{\partial z}{\partial x} = \frac{-x}{\sqrt{4-x^2-y^2}} \qquad \frac{\partial z}{\partial y} = \frac{-y}{\sqrt{4-x^2-y^2}}$

$dS = \sqrt{1 + \frac{x^2}{4-x^2-y^2} + \frac{y^2}{4-x^2-y^2}}\, dA \qquad \iint_S (x^2+y^2)\sqrt{4-x^2-y^2}\, dA =$

$dS = \sqrt{\frac{4-x^2-y^2+x^2+y^2}{4-x^2-y^2}} = \sqrt{\frac{4}{4-x^2-y^2}}\, dA \qquad \iint_S (x^2+y^2)\sqrt{4-x^2-y^2}\left(\frac{2}{\sqrt{4-x^2-y^2}}\right) dA$

$= 2\iint_S x^2+y^2\, dA = 2\int_0^{2\pi}\int_0^2 r^3\, dr\, d\theta = 2\int_0^{2\pi} d\theta \int_0^2 r^3\, dr$

$= 4\pi\left[\frac{16}{4}\right] = \boxed{16\pi}$

(19) $\iint_S xz\, dS \quad y^2+z^2=9 \quad x=0 \quad x+y=5$

$r^2=9 \qquad x=5-y$

$y = 3\cos\theta \quad z = 3\sin\theta \quad \theta \in [0,2\pi] \quad x \in [0, 5-3\cos\theta]$

$r_x = \langle 1,0,0 \rangle \quad r_\theta = \langle 0, -3\sin\theta, 3\cos\theta \rangle \quad r_x \times r_\theta = \langle \begin{vmatrix} 0 & 0 \\ -3\sin\theta & 3\cos\theta \end{vmatrix}, -\begin{vmatrix} 1 & 0 \\ 0 & 3\cos\theta \end{vmatrix}, \begin{vmatrix} 1 & 0 \\ 0 & -3\sin\theta \end{vmatrix} \rangle$

$r_x \times r_\theta = \langle 0, -3\cos\theta, -3\sin\theta \rangle \quad |r_x \times r_\theta| = \sqrt{9} = 3$

S_1

$\iint_{S_1} x(3\sin\theta)\, |r_x \times r_\theta|\, dx\, d\theta = \int_0^{2\pi}\int_0^{5-3\cos\theta} 9x\sin\theta\, dx\, d\theta = \int_0^{2\pi} \frac{9(5-\cos\theta)^2 \sin\theta}{2}\, d\theta$