(23) $F(x,y,z) = \langle xy, yz, zx \rangle$ $\quad z = 4-x^2-y^2$ $\quad x \in [0,1]$ $\quad y \in [0,1]$

$$\iint_S F \cdot ds = \iint_D -P\left(\frac{\partial z}{\partial x}\right) - Q\left(\frac{\partial z}{\partial y}\right) + R \, dA$$

$$= \iint_D -(xy)(-2x) - (yz)(-2y) + zx \, dA$$

$$= \int_0^1 \int_0^1 2x^2y + 2y^2z + xz \, dy\,dx$$

$$= \int_0^1 \int_0^1 2x^2y + 2y^2(4-x^2-y^2) + x(4-x^2-y^2) \, dy\,dx$$

$$= \int_0^1 \int_0^1 2x^2y + 8y^2 - 2x^2y^2 - 2y^4 + 4x - x^3 - xy^2 \, dy\,dx$$

$$= \int_0^1 \left[x^2y^2 + \frac{8}{3}y^3 - \frac{2}{3}x^2y^3 - \frac{2}{5}y^5 + 4xy - x^3y - \frac{1}{3}xy^3 \right]_0^1 dx$$

$$= \int_0^1 x^2 + \frac{8}{3} - \frac{2}{3}x^2 - \frac{2}{5} + 4x - x^3 - \frac{1}{3}x \, dx = \int_0^1 \frac{34}{15} + \frac{12}{3} + \frac{11x}{3} - x^3 \, dx$$

$$= \left[\frac{34}{15}x + \frac{x^3}{9} + \frac{11x^2}{6} - \frac{x^4}{4} \right]_0^1 = \frac{34}{15} + \frac{1}{9} + \frac{11}{6} - \frac{1}{4} = \boxed{\frac{713}{180}}$$