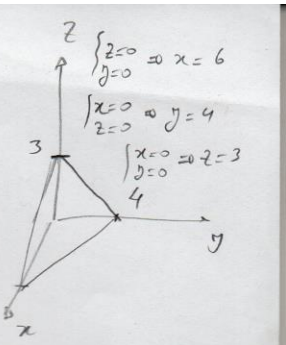
$$\iint_S (x^2, xy, 5)\, ds$$

$2x + 3y + 4z = 12$

$0 \le x \le 6$

$0 \le y \le \frac{12-2x}{3}$

$0 \le z \le \frac{12-2x-3y}{4}$



$(6,0,0)$; $(0,4,0)$; $(0,0,3)$

Plano parametrizado $(0,0,3) + u[(6,0,0) - (0,0,3)] + v[(0,4,0) - (0,0,3)]$

$$\phi = \begin{cases} x = 6u \\ y = 4v \\ z = 3 - 3u - 3v \end{cases}$$

$\phi_u = (6, 0, -3)$

$\phi_v = (0, 4, -3)$

$0 \le u \le 6/6 = 1$

$0 \le v \le \frac{y}{4} = \frac{12-2x}{12} = \frac{12-12u}{12}$

$0 \le v \le 1-u$

$$\phi_u \wedge \phi_v = \begin{vmatrix} i & j & k \\ 6 & 0 & -3 \\ 0 & 4 & -3 \end{vmatrix} = (12, 18, 24)$$

$$\int_0^1 du \int_0^{1-u} (6u)^2, 6u \cdot 4v, 5) \cdot (12, 18, 24)\, dv$$

$$\int_0^1 du \int_0^{1-u} (432u^2 + 432 \cdot u \cdot v + 120)\, dv$$

$$\int_0^1 du \left(432u^2 \cdot v + \frac{432u \cdot v^2}{2} + 120v \Big|_0^{1-u} \right) = \int_0^1 du \left(432u^2 \cdot (1-u) + 216u \cdot (1-u)^2 + 120(1-u) \right)$$

$(1-u)^2 = 1 - 2u + u^2$

$$= \int_0^1 \left(432u^2 - 432u^3 + 216u + 216u^3 - 432u^2 + 120 - 120u \right) du$$

$$\int_0^1 -216u^3 + 96u + 120\, du$$

$$-\frac{216u^4}{4} + \frac{96u^2}{2} + 120u \Big|_0^1 = -\frac{216}{4} + \frac{96}{2} + 120 = -54 + 48 + 120$$

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