

$$3. \iint_S (4xy) \, ds \quad S: z = 5 - x - y \quad \text{1st octant}$$

$$g(x, y) = 5 - x - y \quad g_x = -1 \quad g_y = -1$$

$$= \int_{x=0}^{x=5} \int_{y=0}^{y=5-x} 4xy \sqrt{1 + (-1)^2 + (-1)^2} \, dy \, dx$$

$$\frac{y^2}{2} = 5 - x - y$$

$$0 = 5 - x - y$$

$$y = 5 - x$$

$$\frac{x^2}{2} = 5 - x$$

$$0 = 5 - x$$

$$x = 5$$

$$= 4\sqrt{3} \int_{x=0}^{x=5} \int_{y=0}^{y=5-x} (xy) \, dy \, dx$$

$$= 4\sqrt{3} \int_{x=0}^{x=5} \left[ \frac{1}{2} xy^2 \right]_{y=0}^{y=5-x} \, dx$$

$$= 4\sqrt{3} \int_{x=0}^{x=5} [x(5-x)^2 - x(0)] \, dx$$

$$= \frac{4\sqrt{3}}{2} \int_{x=0}^{x=5} x(25 - 10x + x^2) \, dx$$

$$= 2\sqrt{3} \int_{x=0}^{x=5} (25x - 10x^2 + x^3) \, dx$$

$$= 2\sqrt{3} \left[ \frac{25}{2}x^2 - \frac{10}{3}x^3 + \frac{1}{4}x^4 \right]_{x=0}^{x=5}$$

$$= 2\sqrt{3} \left[ \frac{25}{2}(5)^2 - \frac{10}{3}(5)^3 + \frac{1}{4}(5)^4 \right]$$

$$= \frac{6005\sqrt{3}}{3}$$