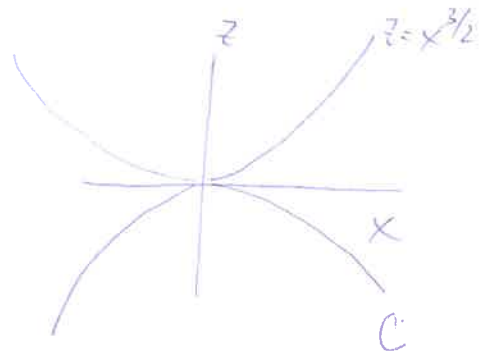


1.

$$C = \{(x, 0, z) : z^2 = |x^3|\}$$

S ... rotate C hollowing z



$$\varphi_1 : (u, v) \mapsto (u^2 \cos v, u^2 \sin v, u^3)$$

$$\begin{bmatrix} x = \pm u^2 \\ z = \pm u^3 \end{bmatrix} \xrightarrow{u > 0}$$

$$\varphi_2 : (u, v) \mapsto (u^2 \cos v, u^2 \sin v, -u^3)$$

$$u > 0, v \in (0, 2\pi)$$

$$\Rightarrow S_1 = \text{Im } \varphi_1, S_2 = \text{Im } \varphi_2$$

$$M_1 = \{(u^2, 0, u^3) : u > 0\}$$

$$M_2 = \{(u^2, 0, -u^3) : u > 0\}$$

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$$M_3 = \{(0, 0, 0)\}$$

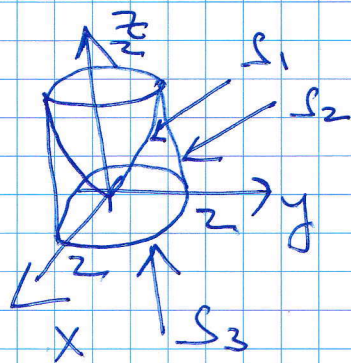
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$$S = S_1 \cup S_2 \cup M_1 \cup M_2 \cup M_3$$

$$T_{\varphi_1(u, v)} S = \text{Lin} \left\{ \begin{pmatrix} 2u \cos v \\ 2u \sin v \\ 3u^2 \end{pmatrix}, \begin{pmatrix} -u^2 \sin v \\ u^2 \cos v \\ 0 \end{pmatrix} \right\}$$

$$T_{\varphi_2(u, v)} S = \text{Lin} \left\{ \begin{pmatrix} 2u \cos v \\ 2u \sin v \\ -3u^2 \end{pmatrix}, \begin{pmatrix} -u^2 \sin v \\ u^2 \cos v \\ 0 \end{pmatrix} \right\}$$

$$\Omega = \{(x, y, z) : x^2 + y^2 < 4, 0 < z < \sqrt{x^2 + y^2}\}$$



S_1

$$\varphi_1: \begin{aligned} x &= r \cos \theta \\ y &= r \sin \theta \\ z &= r \end{aligned} \quad \begin{aligned} \theta &\in [0, 2\pi] \\ r &\in (0, 2) \end{aligned}$$

S_2

$$\varphi_2: \begin{aligned} x &= z \cos \theta \\ y &= z \sin \theta \\ z &= u \end{aligned} \quad \begin{aligned} \theta &\in (0, 2\pi) \\ u &\in (0, 2) \end{aligned}$$

S_3

$$\varphi_3: \begin{aligned} x &= r \cos \theta \\ y &= r \sin \theta \\ z &= 0 \end{aligned} \quad \begin{aligned} \theta &\in (0, 2\pi) \\ r &\in (0, 2) \end{aligned}$$

$$\int_{\partial\Omega} z \, ds = \int_{S_1} z \, ds + \int_{S_2} z \, ds + \int_{S_3} z \, ds$$

$$z|_{S_3} = 0 \Rightarrow \int_{S_3} z \, ds = 0 \quad (*)$$

$$\int_{S_2} z \, ds = \left\{ \varphi_2 = z \right\} = 2\pi \int_0^2 z \, du = 8\pi$$

(*)

$$\int_{S_1} z \, ds = \left\{ \varphi_1 = \sqrt{2} r \right\} = 2\pi \int_0^2 \sqrt{2} r^2 \, dr = \frac{16\sqrt{2}}{3} \pi$$

(*)

$$\int_{\partial\Omega} z \, ds = 8\pi + \frac{16\sqrt{2}}{3} \pi = \left(8 + \frac{16\sqrt{2}}{3} \right) \pi$$

$$(*), (*), (*)$$