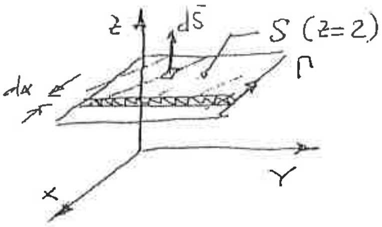
$$\bar{A} = 2xz\,\bar{i} + z\,\text{sen}x\,\bar{j} + (x^2+y^2-z^2)\,\bar{k}$$

a) $$\nabla\wedge\bar{A} = \begin{vmatrix} \bar{i} & \bar{j} & \bar{k} \\ \partial/\partial x & \partial/\partial y & \partial/\partial z \\ 2xz & z\,\text{sen}x & x^2+y^2-z^2 \end{vmatrix} = (2y - \text{sen}x)\,\bar{i} + z\cos x\,\bar{k}$$

de manera análoga:

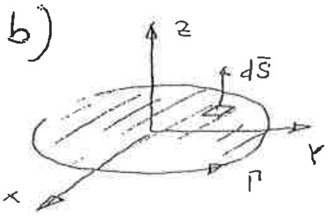
$$\nabla\wedge(\nabla\wedge\bar{A}) = z\,\text{sen}x\,\bar{j} - 2\,\bar{k}$$




— Tomando como sentido de circulación el indicado en la figura

$$\Gamma = \oint_\Gamma (\nabla\wedge\bar{A})\cdot d\vec{\ell} \underset{\text{T. Stokes}}{=} \int_{S(\text{rayada})} \nabla\wedge(\nabla\wedge\bar{A})\cdot d\bar{S} \underset{d\bar{S}=dS\bar{k}}{=} -\int 2\,dS = -$$

b)

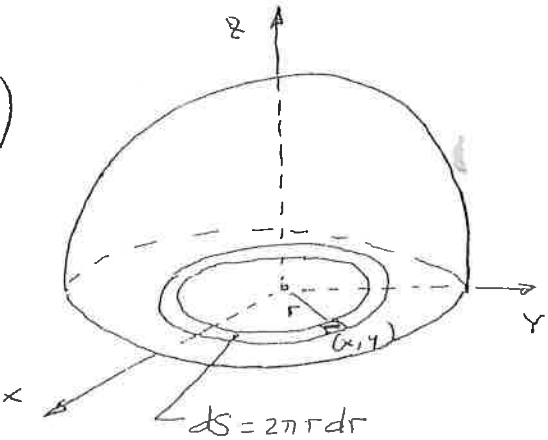



$$\Gamma = \oint_\Gamma \bar{A}\cdot d\bar{\ell} = \int_{S(\text{rayada})} (\nabla\wedge\bar{A})\cdot d\bar{S} \underset{(d\bar{S}=dS\bar{k})}{=} \int_S z\cos x\,dS \underset{\substack{\text{por estar } S \text{ en} \\ \text{el plano } z=0}}{=} 0$$

c) $$\phi = \int_S (\nabla\wedge\bar{A})\cdot d\vec{S} \underset{d\bar{S}=dS\bar{k}}{=} \int_S z\cos x\,dS \underset{(\text{ver fig})}{=} 4\int_0^2 \cos x\,dx = 4\,\text{sen}\,2$$

$\left( dS = 2dx \right.$ por estar $S$ en el plano $z=2 \left. \right)$

d)




$$\phi = \int_{\substack{\text{Semiesf.} \\ \text{abierta}}} \bar{A}\cdot d\bar{S} = \int_{\substack{\text{Semiesf.} \\ \text{Cerrada}}} \bar{A}\cdot d\bar{S} - \int_{\substack{\text{Círculo} \\ \text{Base}}} \bar{A}\cdot d\bar{S}$$

donde:

$$\int_{\substack{\text{Semiesf.} \\ \text{Cerrada}}} \bar{A}\cdot d\bar{S} \underset{\text{T. Gauss}}{=} \int_v (\nabla\cdot\bar{A})\,dv \underset{\nabla\cdot\bar{A}=0}{=} 0$$

$$\int_{\text{círculo}} \bar{A}\cdot d\bar{S} \underset{d\bar{S}=-\bar{k}dS}{=} -\int_{S(z=0)} (x^2+y^2-\cancel{z^2}^{\,0})\,dS \underset{\substack{x^2+y^2=r^2 \\ (\text{ver figura})}}{=} -\int_0^2 r^2\,2\pi r\,dr = -8\pi$$

Así $$\phi = 8\pi$$