$$S: \begin{cases} x^2+y^2=1 \\ |z|<1 \end{cases}$$ n extremos de $x^2+y^2=1$

$f = \mathrm{Rot}\, h$

h é potencial vector de f

$f = \mathrm{Rot}(h+\nabla\phi)$

$\mathrm{Rot}(\nabla\phi)=0$

$f(x,y,z)=(0,-z,-y^2)$

$f=\mathrm{Rot}\, h$ então $\mathrm{div}\, f = \mathrm{div}(\mathrm{Rot}\, h)=0$

$$\int_S f\cdot n = \int_S \mathrm{Rot}(h)\cdot n = \oint_{\partial S} h$$

$$\mathrm{Rot}\, h = f \iff \begin{cases} \cancel{\partial_2 h_3} - \partial_3 h_2 = f_1 = 0 & \Rightarrow h_2 = a(x,y) \\ \partial_3 h_1 - \cancel{\partial_1 h_3} = f_2 = -z & \Rightarrow \partial_3 h_1 = -z \Rightarrow -\frac{z^2}{2}+b(x,y) \\ \partial_1 h_2 - \partial_2 h_1 = f_3 = -y^2 \end{cases}$$

$$\frac{d}{dx}(a) - \frac{\partial}{\partial y}\left(-\frac{z^2}{2}+b\right) = -y^2$$

$a = xy^2$; $b=0$ $\quad h(x,y,z) = \left(-\frac{z^2}{2}, xy^2, 0\right)$

$g(\theta) = (\cos(\theta), \sin(\theta), -1)$

$g'(\theta) = (-\sin, \cos, 0)$

$$\oint_A h\, dg = \int_0^{2\pi} \left(-\frac{1}{2}, -\cos\sin^2, 0\right)\cdot(-\sin, \cos, 0)\, d\theta$$