Eletromagnetismo

28 de março
Análise vetorial

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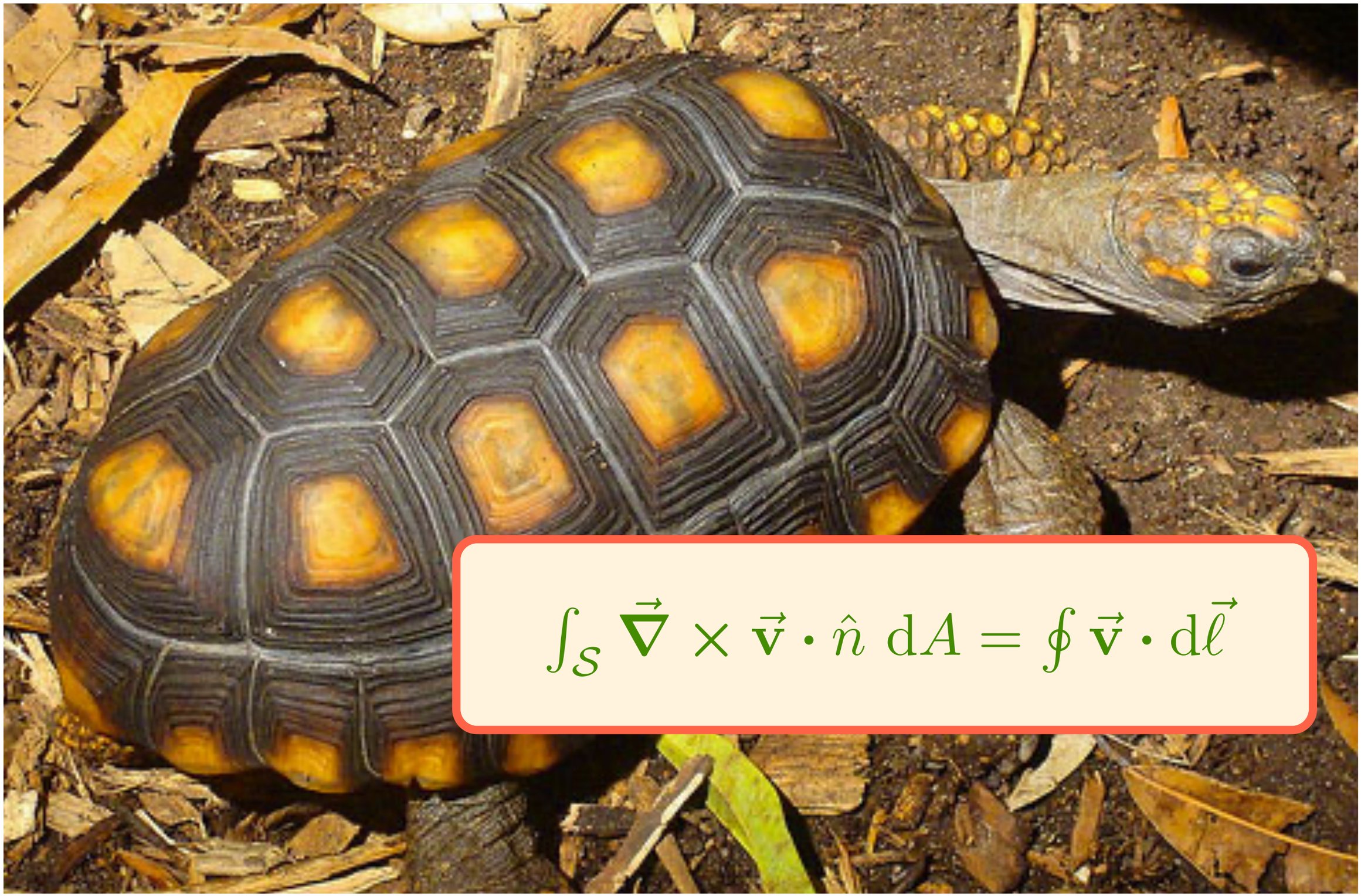
Teoremas fundamentais

$$\int_{\mathcal{C}} \vec{\boldsymbol{\nabla}} T \cdot \mathrm{d}\vec{\ell} = T_b - T_a$$

$$\int_{\mathcal{S}} \vec{\boldsymbol{\nabla}} \times \vec{\mathbf{v}} \cdot \hat{n}\, \mathrm{d}A = \oint \vec{\mathbf{v}} \cdot \mathrm{d}\vec{\ell}$$

$$\int_{\mathcal{V}} \vec{\boldsymbol{\nabla}} \cdot \vec{\mathbf{v}}\, \mathrm{d}\tau = \int \vec{\mathbf{v}} \cdot \hat{n}\, \mathrm{d}A$$

Rotacional

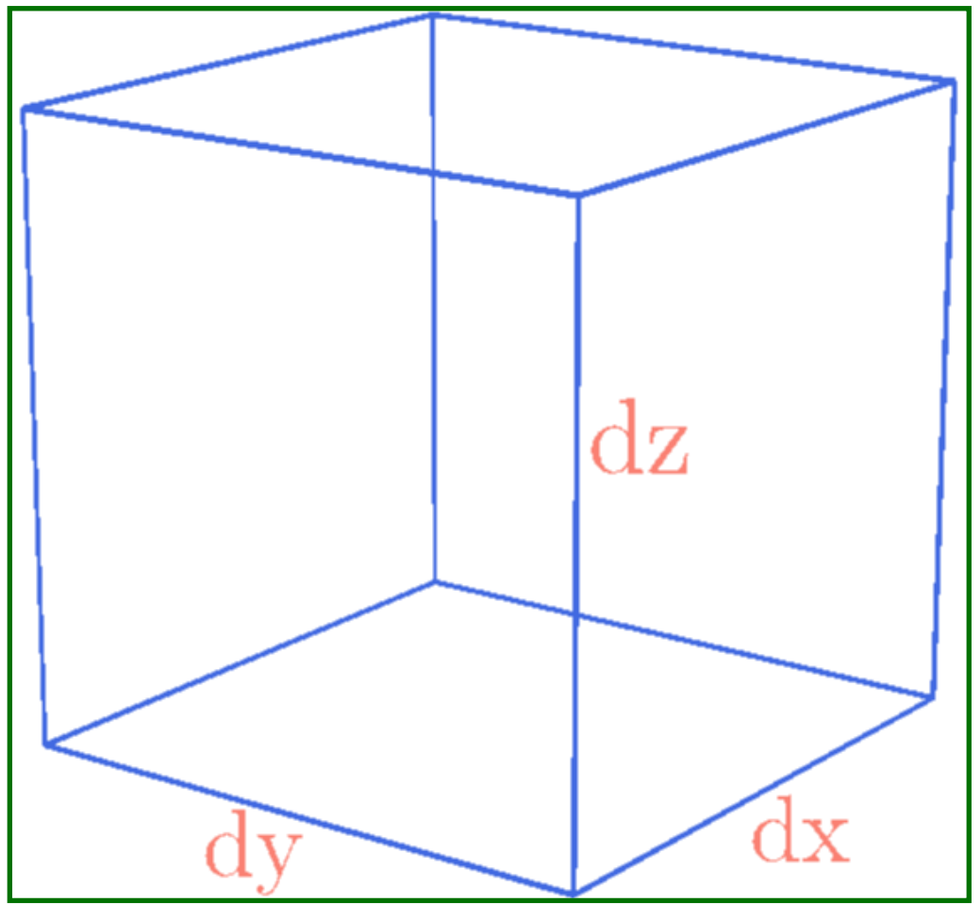


$$\int_S \vec{\nabla} \times \vec{\mathbf{v}} \cdot \hat{n} \, \mathrm{d}A = \oint \vec{\mathbf{v}} \cdot \mathrm{d}\vec{\ell}$$

Cartesianas

$$\mathrm{d}\vec{\ell} = \mathrm{d}x\,\hat{x} + \mathrm{d}y\,\hat{y} + \mathrm{d}z\,\hat{z}$$

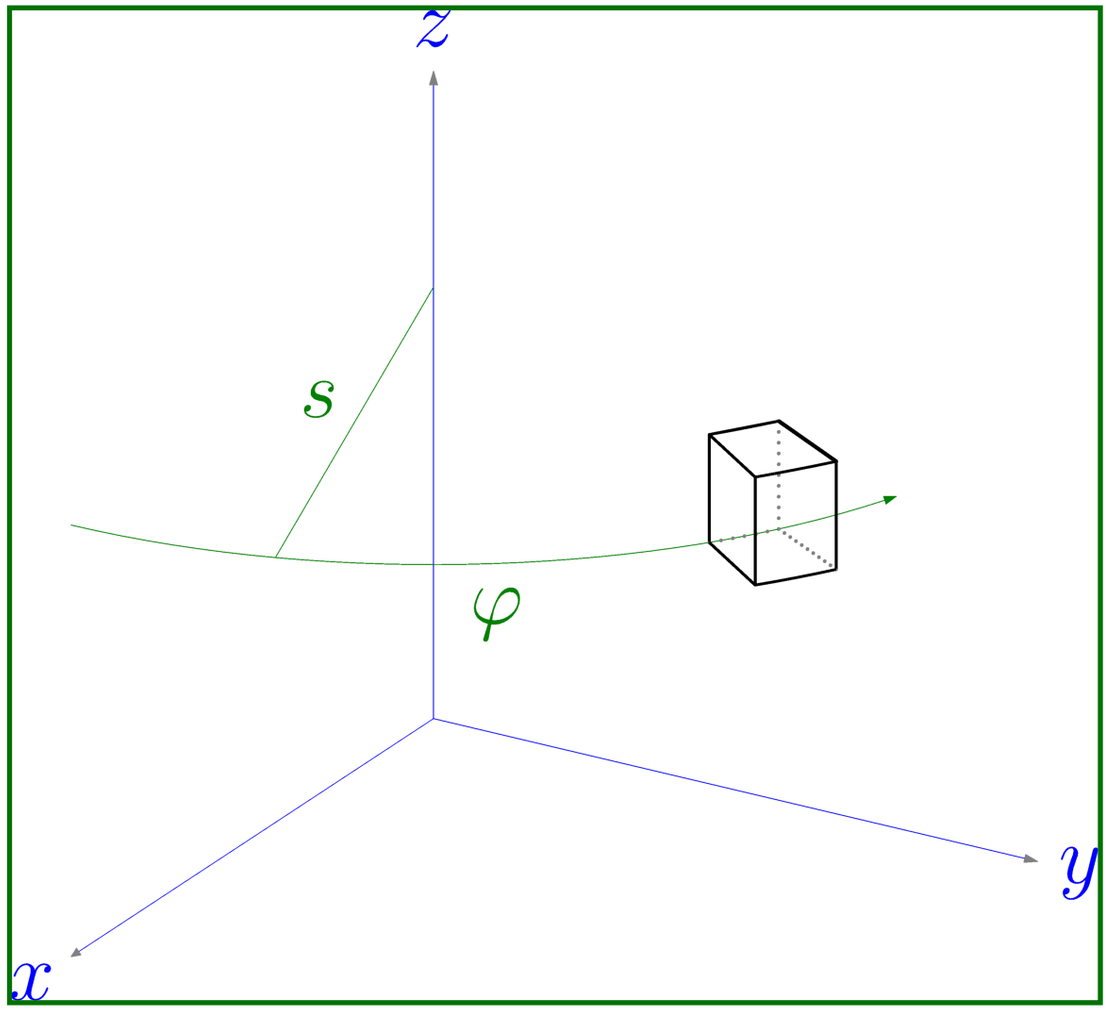
$$\vec{\boldsymbol{\nabla}} \times \vec{\mathbf{v}} = \left(\frac{\partial v_z}{\partial y} - \frac{\partial v_y}{\partial z}\right)\hat{x} + \left(\frac{\partial v_x}{\partial z} - \frac{\partial v_z}{\partial x}\right)\hat{y} + \left(\frac{\partial v_y}{\partial x} - \frac{\partial v_x}{\partial y}\right)\hat{z}$$



Coordenadas cilíndricas

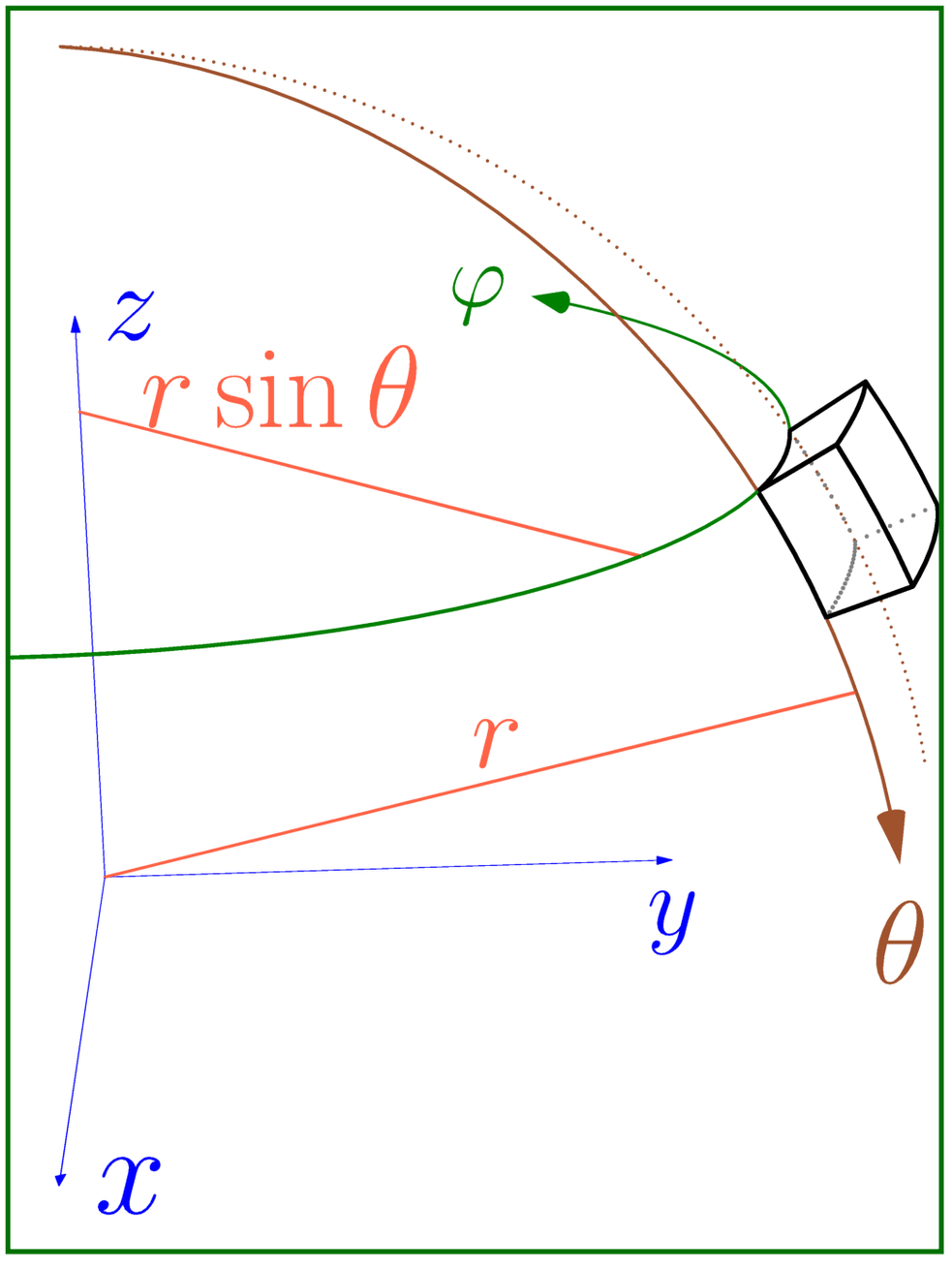
$$\mathrm{d}\vec{\ell} = \mathrm{d}s\,\hat{s} + s\,\mathrm{d}\varphi\,\hat{\varphi} + \mathrm{d}z\,\hat{z}$$

$$\vec{\boldsymbol{\nabla}} \times \vec{\mathbf{v}} = \left(\frac{1}{s}\frac{\partial v_z}{\partial \varphi} - \frac{\partial v_\varphi}{\partial z}\right)\hat{s}$$
$$+ \left(\frac{\partial v_s}{\partial z} - \frac{\partial v_z}{\partial s}\right)\hat{\varphi}$$
$$+ \frac{1}{s}\left(\frac{\partial (s v_\varphi)}{\partial s} - \frac{\partial v_s}{\partial \varphi}\right)\hat{z}$$



Coordenadas esféricas

$$\mathrm{d}\vec{\ell} = \mathrm{d}r\,\hat{r} + r\,\mathrm{d}\theta\,\hat{\theta} + r\sin\theta\,\mathrm{d}\phi\,\hat{\phi}$$



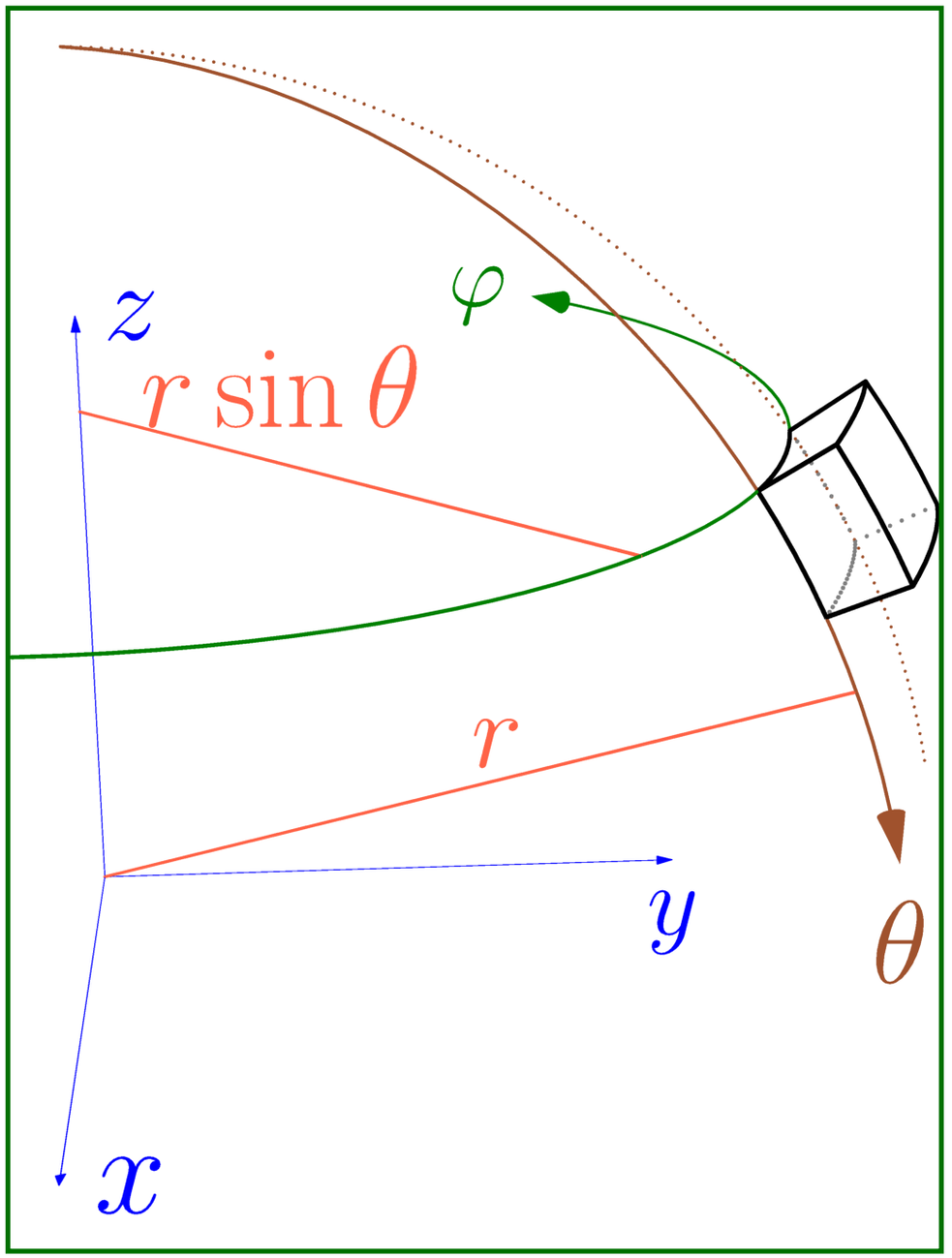
Coordenadas esféricas

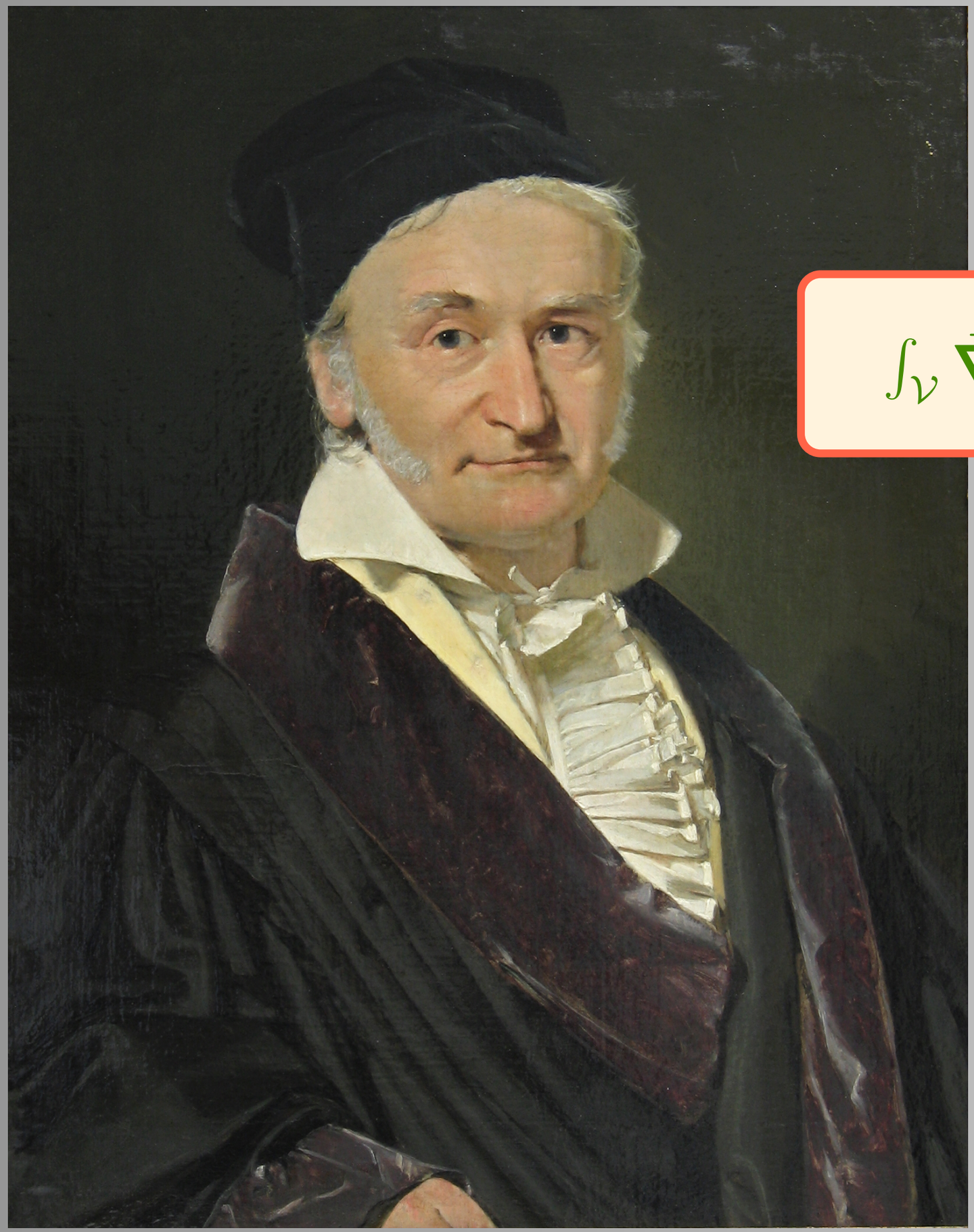
$$\mathrm{d}\vec{\ell} = \mathrm{d}r\,\hat{r} + r\,\mathrm{d}\theta\,\hat{\theta} + r\sin\theta\,\mathrm{d}\varphi\,\hat{\varphi}$$

$$\vec{\nabla}\times\vec{\mathbf{v}} = \frac{1}{r\sin\theta}\left(\frac{\partial(\sin\theta v_\varphi)}{\partial\theta} - \frac{\partial v_\theta}{\partial\varphi}\right)\hat{r}$$

$$+\frac{1}{r}\left(\frac{1}{\sin\theta}\frac{\partial v_r}{\partial\varphi} - \frac{\partial(rv_\varphi)}{\partial r}\right)\hat{\theta}$$

$$+\frac{1}{r}\left(\frac{\partial(rv_\theta)}{\partial r} - \frac{\partial v_r}{\partial\theta}\right)\hat{\varphi}$$





Divergente

$$\int_{\mathcal{V}} \vec{\boldsymbol{\nabla}} \cdot \vec{\mathbf{v}} \, \mathrm{d}\tau = \int \vec{\mathbf{v}} \cdot \hat{n} \, \mathrm{d}A$$