1.5.9

dia

(29) $\nabla(\phi\psi) = \phi\nabla\psi + \psi\nabla\phi$

$\nabla(\phi\psi) = \partial_i \phi^j \psi^k =$

$= \psi^k \partial_i \phi^j + \phi^j \partial_i \psi^k$

$= \psi\nabla\phi + \phi\nabla\psi$

día mes año

(2d) $\nabla \cdot \underbrace{(a \times b)}_{\text{vector}}$

Escalar

Ahora bien: $\nabla \times \underbrace{(D \cdot a)}_{\text{Escalar}}$

No se le puede aplicar un rotacional a un escalar

(2f) $\nabla \times (\nabla \times a) = \nabla(\nabla \cdot a) - \nabla^2 a$

$[\nabla \times (\nabla \times a)] = \varepsilon_{ijk} \partial^j (\nabla \times a)^k$

$= \varepsilon_{ijk} \partial^j \varepsilon^{mnk} \partial_m a_n$

$= [\delta^m_i \delta^n_j - \delta^m_j \delta^n_i] \partial^j \partial_m a_n$

$= [\delta^m_i \delta^n_j \partial^j \partial_m a_n + \delta^m_j \delta^n_i \partial^j \partial_m a_n]$

$\therefore [\partial^j \partial^i a_j - \partial^m \partial_m a^i$

$= [\partial^i \partial^j a_j - \partial^m \partial_m a^i$

$= \nabla(\nabla \cdot a) - \nabla \cdot \nabla a$

$= \underline{\nabla(\nabla \cdot a) - \nabla^2 a}$