

Proof of  $\vec{\nabla} \cdot (\phi \vec{A}) = \vec{A} \cdot \vec{\nabla} \phi + \phi \vec{\nabla} \cdot \vec{A}$

$$\begin{aligned}\vec{\nabla} \cdot (\phi \vec{A}) &= \partial_i (\phi A_i) = \phi \partial_i A_i + A_i \partial_i \phi \\ &= \phi \vec{\nabla} \cdot \vec{A} + (\vec{A} \cdot \vec{\nabla}) \phi\end{aligned}$$

which is trivial