

• We wish to expand $\vec{\nabla}(\phi\psi)$ using 108

$$\begin{aligned}\vec{\nabla}(\phi\psi) &= \partial_j(\phi\psi) = \phi\partial_j\psi + \psi\partial_j\phi \\ &= \phi\vec{\nabla}\psi + \psi\vec{\nabla}\phi\end{aligned}$$

Note: since it is a vector relation then proved in one frame is proved in all

• We wish to expand $\vec{\nabla}(\phi\psi)$ using $\nabla\psi$. Since $\nabla\psi$ is linear in its derivative as evidenced by

$$\text{grad}(\phi) = \sum_i \vec{e}_i \frac{1}{h_i} \frac{\partial}{\partial y^i} \phi$$

$$\text{then } \text{grad}(\phi\psi) = \phi \text{grad}(\psi) + \psi \text{grad}(\phi)$$

$$\text{since } \frac{\partial}{\partial y^i}(\phi\psi) = \phi \frac{\partial}{\partial y^i} \psi + \psi \frac{\partial}{\partial y^i} \phi$$