$$\mathbf{A} = A^{x} \mathbf{e}_{x} + A^{y} \mathbf{e}_{y} + A^{z} \mathbf{e}_{z}$$

$$\mathbf{v} \cdot \nabla = v^{x} \frac{\partial}{\partial x} + v^{y} \frac{\partial}{\partial y} + v^{z} \frac{\partial}{\partial z}$$

$$\nabla^{2} = \frac{\partial^{2}}{\partial x^{2}} + \frac{\partial^{2}}{\partial y^{2}} + \frac{\partial^{2}}{\partial z^{2}}$$

 $oldsymbol{X} = xoldsymbol{e_r} + yoldsymbol{e_u} + zoldsymbol{e_z}$

$$\begin{aligned}
& \partial x^2 - \partial y^2 - \partial z^2 \\
& \mathbf{v} \cdot \nabla f = v^x \partial_x f + v^y \partial_y f + v^z \partial_z f \\
& \nabla^2 f = \partial_x^2 f + \partial_y^2 f + \partial_z^2 f \\
& \nabla^2 \mathbf{A} = \left(\partial_x^2 A^x + \partial_y^2 A^x + \partial_z^2 A^x\right) \mathbf{e_x} + \left(\partial_x^2 A^y + \partial_y^2 A^y + \partial_z^2 A^y\right) \mathbf{e_y} + \left(\partial_x^2 A^z + \partial_y^2 A^z + \partial_z^2 A^z\right) \mathbf{e_z}
\end{aligned}$$

$$\bar{\nabla} \cdot v = v^x \frac{\partial}{\partial x} + v^y \frac{\partial}{\partial y} + v^z \frac{\partial}{\partial z}$$

$$= 0$$

$$= 0$$

$$= 0$$

$$= 0$$

$$= 0$$

$$v^{x} \frac{\partial}{\partial x} + v^{y} \frac{\partial}{\partial y} + v^{z} \frac{\partial}{\partial z}$$

$$= x \frac{\partial}{\partial x} + y \frac{\partial}{\partial y} + z \frac{\partial}{\partial z}$$

$$egin{aligned} & \partial x & \partial y & \partial z \ & m{X} \cdot
abla & = x rac{\partial}{\partial x} + y rac{\partial}{\partial y} + z rac{\partial}{\partial z} \ & ar{
abla} \cdot m{X} & = 3 + x rac{\partial}{\partial x} + y rac{\partial}{\partial y} + z rac{\partial}{\partial z} \end{aligned}$$

$$\begin{aligned}
\partial x & \partial y & \partial z \\
\cdot \mathbf{X} &= 3 + x \frac{\partial}{\partial x} + y \frac{\partial}{\partial y} + z \frac{\partial}{\partial z} \\
\vdots & \nabla - \nabla \cdot \mathbf{X} &= -3 \\
z &= -2 \frac{\partial}{\partial x} \frac{\partial^2}{\partial y} & 1 & \partial z \frac{\partial^2}{\partial y} & 1 & \partial^2
\end{aligned}$$

$$\mathbf{X} \cdot \nabla - \bar{\nabla} \cdot \mathbf{X} = -3$$

$$\nabla^2 = \nabla \cdot \nabla = \frac{2}{r} \frac{\partial}{\partial r} + \frac{\partial^2}{\partial r^2} + \frac{1}{r^2 \tan(\theta)} \frac{\partial}{\partial \theta} + r^{-2} \frac{\partial^2}{\partial \theta^2} + \frac{1}{r^2 \sin^2(\theta)} \frac{\partial^2}{\partial \phi^2}$$

 $\nabla \cdot (\nabla f) = \frac{1}{r^2} \left(r^2 \partial_r^2 f + 2r \partial_r f + \partial_\theta^2 f + \frac{\partial_\theta f}{\tan(\theta)} + \frac{\partial_\phi^2 f}{\sin^2(\theta)} \right)$

$$\nabla^{2} = \nabla \cdot \nabla = \frac{1}{r} \frac{\partial}{\partial r} + \frac{\partial}{\partial r^{2}} + \frac{1}{r^{2} \tan(\theta)} \frac{\partial}{\partial \theta} + r^{-2} \frac{\partial}{\partial \theta^{2}} + \frac{1}{r^{2} \sin^{2}(\theta)} \frac{\partial}{\partial \phi^{2}}$$

$$(\nabla^{2}) f = \frac{1}{r^{2}} \left(r^{2} \partial_{r}^{2} f + 2r \partial_{r} f + \partial_{\theta}^{2} f + \frac{\partial_{\theta} f}{\tan(\theta)} + \frac{\partial_{\phi}^{2} f}{\sin^{2}(\theta)} \right)$$