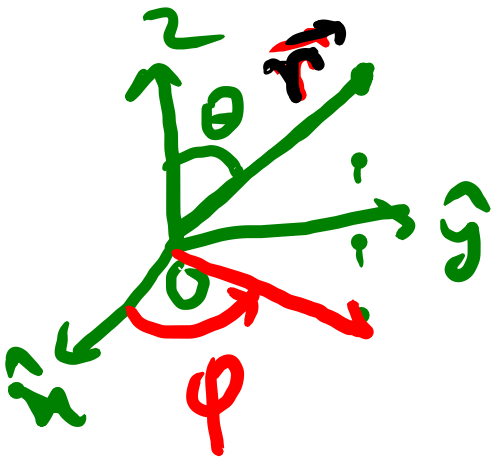
Assignment - 1

Unit - 1

1) Express $\hat{r}, \hat{\theta}, \hat{\phi}$ in terms of $(\hat{x}, \hat{y}, \hat{z})$ & vice-versa:



2) Derive operator $\vec{\nabla}$ (del) in spherical coordinates from rectangular coordinates.

Hints:

i) express (r, θ, ϕ) as a function of (x, y, z)

ii) also $(\hat{x}, \hat{y}, \hat{z}) \rightarrow (r, \theta, \phi)\ \hat{r}\ \hat{\theta}\ \hat{\phi}$

iii) $\frac{\partial}{\partial x} = \frac{\partial}{\partial r}\left(\frac{\partial r}{\partial x}\right) + \frac{\partial}{\partial \theta}\left(\frac{\partial \theta}{\partial x}\right) + \frac{\partial}{\partial \phi}\left(\frac{\partial \phi}{\partial x}\right)$

$\frac{\partial}{\partial y} = \ldots$

$\frac{\partial}{\partial z} =$

3) Derive the expression of div $\vec{A}$ $(\vec{\nabla}.\vec{A})$ in spherical coordinate:

$$\vec{A} = A_r\hat{r} + A_\theta\hat{\theta} + A_\phi\hat{\phi}$$ (spherical coordinate)

$$\vec{A} = A_x\hat{x} + A_y\hat{y} + A_z\hat{z}$$ (Cartesian Co-ordinate)

Hints :- Use expression in Assignment (1) & (2)

P.N. :→ A_r is a function of (A_x, A_y, A_z)

$A_\theta = f(A_x, A_y, A_z)$, $A_\phi = (A_x, A_y, A_z)$