1st Assignment
Subject: Classical Physics (Electrodynamics)

1. **Compute the divergence and curl of the following vector fields.**

   (i) $\vec{F} = \rho(2+\sin^2\phi)\hat{\rho} + \rho\sin\phi\cos\phi\,\hat{\phi} + 3z\hat{z}$

   (ii) $\vec{F} = (r\cos\theta)\,\hat{r} + (r\sin\theta)\;\hat{\theta} + (r\sin\theta\cos\phi)\;\hat{\phi}$

2. **Draw the following vector fields on XY plane.**

   (i) $\vec{V} = s\sin\phi\hat{\phi}$

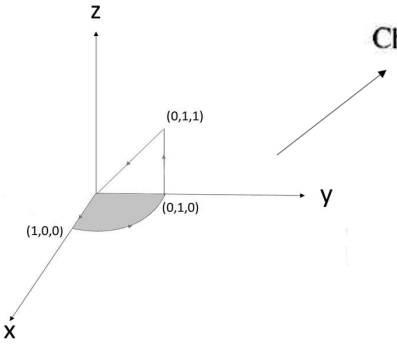
   (ii) $\vec{V} = c\cos\phi\,\hat{\phi} - \sin\phi\,\hat{s}$

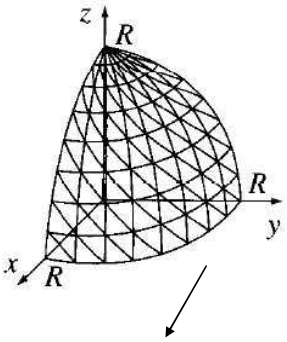
3. **The vector field is given in Cartesian co-ordinate system,** $\vec{A} = xy\,\hat{i} + (3x^2 + y)\,\hat{j}$**. Write down the vector field in cylindrical co-ordinate system with** $\hat{s}, \hat{\phi}, \hat{z}$ **unit vectors.**

4. Compute the line integral of

   $\mathbf{v} = (r\cos^2\theta)\,\hat{\mathbf{r}} - (r\cos\theta\sin\theta)\,\hat{\boldsymbol{\theta}} + 3r\,\hat{\boldsymbol{\phi}}$ around the path shown in Fig.

   Check your answer, using Stokes' theorem





5. Check the divergence theorem for the function

   $\mathbf{v} = r^2\cos\theta\,\hat{\mathbf{r}} + r^2\cos\phi\,\hat{\boldsymbol{\theta}} - r^2\cos\theta\sin\phi\,\hat{\boldsymbol{\phi}}$,

   using as your volume one octant of the sphere of radius R Make sure you include the *entire* surface.

6. Consider a vector field, $\vec{A} = -y\hat{i} + x\hat{j}$**. Calculate closed line integral of the function along a circular path of radius 1 in anti-clockwise direction.**