Consider the following three vector fields in (respectively) rectangular, spherical, and cylindrical coordinates:

$$\begin{aligned} \mathbf{A} &= (xy)\,\hat{\mathbf{i}} + (2yz)\,\hat{\mathbf{j}} + (3zx)\,\hat{\mathbf{k}} \\ \mathbf{B} &= \frac{\sin\theta}{r}\,\hat{\boldsymbol{\theta}} \\ \mathbf{C} &= \frac{1}{r}\,\hat{\mathbf{r}} + r\,\hat{\boldsymbol{\phi}} \end{aligned}$$

1. Report the values of r, θ, ϕ (spherical) for the point $(x, y, z) = (1, 1, 1)$. Report the values of r, z, ϕ (cylindrical) for the point $(x, y, z) = (1, 1, 1)$. Note: r means different things in spherical and cylindrical coordinates.
2. Find the x, y, and z components of the three vectors **A, B, C** at the point $(x, y, z) = (1, 1, 1)$. Note: You will need to determine the components of, for example, $\hat{\boldsymbol{\theta}}$.
3. Calculate the curl of the above three vector fields
4. Calculate the divergence of the above three vector fields.

Consider the following three vector fields in (respectively) rectangular, spherical, and cylindrical coordinates:

$$\begin{aligned} \mathbf{A} &= (xy)\,\hat{\mathbf{i}} + (2yz)\,\hat{\mathbf{j}} + (3zx)\,\hat{\mathbf{k}} \\ \mathbf{B} &= \frac{\sin\theta}{r}\,\hat{\boldsymbol{\theta}} \\ \mathbf{C} &= \frac{1}{r}\,\hat{\mathbf{r}} + r\,\hat{\boldsymbol{\phi}} \end{aligned}$$

1. Report the values of r, θ, ϕ (spherical) for the point $(x, y, z) = (1, 1, 1)$. Report the values of r, z, ϕ (cylindrical) for the point $(x, y, z) = (1, 1, 1)$. Note: r means different things in spherical and cylindrical coordinates.
2. Find the x, y, and z components of the three vectors **A, B, C** at the point $(x, y, z) = (1, 1, 1)$. Note: You will need to determine the components of, for example, $\hat{\boldsymbol{\theta}}$.
3. Calculate the curl of the above three vector fields
4. Calculate the divergence of the above three vector fields.