

1.2.8 Express the vector field $\mathbf{A} = 3\mathbf{u}_x + 4\mathbf{u}_y + 5\mathbf{u}_z$ in cylindrical coordinates. Check your answer using MATLAB.

$$\begin{aligned}\rho &= \sqrt{x^2 + y^2} \\ &= \sqrt{3^2 + 4^2} \\ &= 5\end{aligned}$$

$$\begin{aligned}\phi &= \tan^{-1} \left(\frac{y}{x} \right) \\ &= \tan^{-1} \left(\frac{4}{3} \right) \\ &\approx 0.927\end{aligned}$$

The values of z are the same in both coordinate systems. Therefore, the final vector in cylindrical coordinates is $\mathbf{A} \approx 5\mathbf{u}_\rho + 0.927\mathbf{u}_\phi + 5\mathbf{u}_z$.