

Curl in cylindrical coordinates can be written in several ways:

$$\begin{vmatrix} \frac{1}{\rho} \hat{\rho} & \hat{\phi} & \frac{1}{\rho} \hat{z} \\ \frac{\partial}{\partial \rho} & \frac{\partial}{\partial \phi} & \frac{\partial}{\partial z} \\ A_\rho & \rho A_\phi & A_z \end{vmatrix} = \frac{1}{\rho} \begin{vmatrix} \hat{\rho} & \rho \hat{\phi} & \hat{z} \\ \frac{\partial}{\partial \rho} & \frac{\partial}{\partial \phi} & \frac{\partial}{\partial z} \\ A_\rho & \rho A_\phi & A_z \end{vmatrix} = \begin{vmatrix} \hat{\rho} & \hat{\phi} & \hat{z} \\ \frac{\partial}{\partial \rho} & \frac{1}{\rho} \frac{\partial}{\partial \phi} & \frac{\partial}{\partial z} \\ A_\rho & A_\phi & A_z \end{vmatrix}$$

The first form is as per the *Physics Mathematical Formula* handbook. To get to the second form, take out a $1/\rho$ from the top row, and then to get to the third form, take out a ρ from the middle column.