$\vec{V} = z\hat{i} + 2x\hat{j} + y\hat{k}$

Base das coord. cilíndricas:

$x = \rho\cos\phi$

$y = \rho\sin\phi$

$z = z$

$$\begin{cases} \hat{e}_\rho = \cos\phi\,\hat{i} + \sin\phi\,\hat{j} + 0\hat{k} \\ \hat{e}_\phi = -\sin\phi\,\hat{i} + \cos\phi\,\hat{j} + 0\hat{k} \\ \hat{e}_z = 0\,\hat{i} + 0\,\hat{j} + 1\hat{k} \end{cases}$$

$$\begin{cases} \hat{i} = \cos\phi\,\hat{e}_\rho - \sin\phi\,\hat{e}_\phi + 0\,\hat{e}_z \\ \hat{j} = \sin\phi\,\hat{e}_\rho + \cos\phi\,\hat{e}_\phi + 0\,\hat{e}_z \\ \hat{k} = 0\,\hat{e}_\rho + 0\,\hat{e}_\phi + 1\,\hat{e}_z \end{cases}$$

1º passo:

$\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$

$\Rightarrow \vec{V} = z\hat{i} + 2\rho\cos\phi\,\hat{j} + \rho\sin\phi\,\hat{k}$

2º passo:

$= z(\cos\phi\,\hat{e}_\rho - \sin\phi\,\hat{e}_\phi) + 2\rho\cos\phi(\sin\phi\,\hat{e}_\rho + \cos\phi\,\hat{e}_\phi) + \rho\sin\phi\,\hat{e}_z$

3º passo:

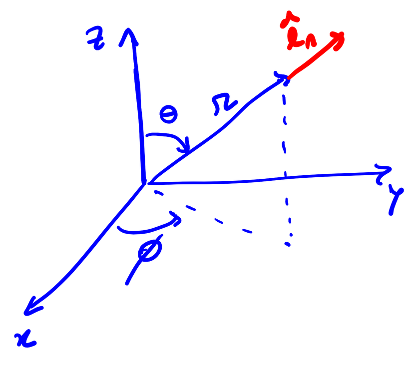
$= (z\cos\phi + 2\rho\cos\phi\sin\phi)\,\hat{e}_\rho$

$+ (-z\sin\phi + 2\rho\cos\phi\cos\phi)\,\hat{e}_\phi$

$+ \rho\sin\phi\,\hat{e}_z$

$= (z\cos\phi + \rho\sin 2\phi)\,\hat{e}_\rho + (-z\sin\phi + 2\rho\cos^2\phi)\,\hat{e}_\phi + \rho\sin\phi\,\hat{e}_z$

Vetor posição em coordenadas esféricas



$r = \sqrt{x^2 + y^2 + z^2}$

$= |\vec{r}|$

$\vec{r} = r\,\hat{e}_r + 0\,\hat{e}_\theta + 0\,\hat{e}_\phi$

$\hat{e}_r = \frac{\vec{r}}{|\vec{r}|} \Rightarrow \vec{r} = |\vec{r}|\,\hat{e}_r$

$= r\,\hat{e}_r$

$\Rightarrow \vec{r} = r\,\hat{e}_r$