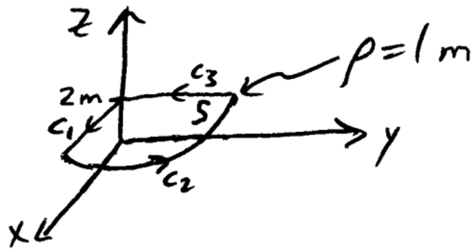
Verify Stoke's Theorem, $\iint_S (\bar\nabla\times\bar A)\bullet d\bar s = \oint_L \bar A\bullet d\bar l$, for the vector field $\bar F = \hat a_\rho + z\,\hat a_\phi + \hat a_z$ (pans/m) for the contour L surrounding surface S described by $0 \le \rho \le 1$ m, $0 \le \phi \le \pi/2$, and z = 2 m.



LHS

$$\bar\nabla\times\bar F = \hat a_\rho\left(\frac{1}{\rho}\overset{0}{\cancel{\frac{\partial F_z}{\partial\phi}}} - \underbrace{\frac{\partial F_\phi}{\partial z}}_{\to 1}\right) + \hat a_\phi\left(\underbrace{\cancel{\frac{\partial F_\rho}{\partial z}}}_{\to 0} - \underbrace{\cancel{\frac{\partial F_z}{\partial\rho}}}_{\to 0}\right) + \hat a_z\left(\frac{1}{\rho}\frac{\partial(\rho F_\phi)}{\partial\rho} - \frac{1}{\rho}\underbrace{\cancel{\frac{\partial F_\rho}{\partial\phi}}}_{\to 0}\right)$$

$$= \underline{-\hat a_\rho + \hat a_z \frac{1}{\rho} z \quad \left(\frac{\text{pans}}{m^2}\right)}$$

$$\iint_S (\bar\nabla\times\bar F)\bullet d\bar s_z = \int_{\rho=0}^{1}\int_{\phi=0}^{\pi/2}\left(-\hat a_\rho + \hat a_z \frac{z}{\rho}\right)\bullet \hat a_z\,\rho\, d\phi\, d\rho$$

$$= \int_{\rho=0}^{1}\int_{\phi=0}^{\pi/2} \overset{2}{\cancel{z}}\, d\phi\, d\rho = 2(1-0)(\pi/2 - 0)$$

$$\underline{\underline{\iint_S (\bar\nabla\times\bar F)\bullet d\bar s_z = \pi \text{ (pans)} = 3.1416 \text{ (pans)}}}$$

RHS

$$\oint_L \bar F\bullet d\bar l = \int_{c_1}(\hat a_\rho + \overset{2}{\cancel{z}}\hat a_\phi + \hat a_z)\bullet(d\rho\,\hat a_\rho + \rho\, \overset{0}{\cancel{d\phi}}\,\hat a_\phi + \overset{0}{\cancel{dz}}\,\hat a_z)$$

$$+ \int_{c_2}(\hat a_\rho + \overset{2}{\cancel{z}}\hat a_\phi + \hat a_z)\bullet(\overset{0}{\cancel{d\rho}}\,\hat a_\rho + \overset{1}{\cancel{\rho}}\, d\phi\,\hat a_\phi + \overset{0}{\cancel{dz}}\,\hat a_z)$$

$$+ \int_{c_3}(\hat a_\rho + \overset{2}{\cancel{z}}\hat a_\phi + \hat a_z)\bullet(d\rho\,\hat a_\rho + \rho\, \overset{0}{\cancel{d\phi}}\,\hat a_\phi + \overset{0}{\cancel{dz}}\,\hat a_z)$$

$$= \cancel{\int_{\rho=0}^{1} d\rho} + \int_{\phi=0}^{\pi/2} z\, d\phi + \cancel{\int_{\rho=1}^{0} d\rho} = (\pi/2 - 0)\, z$$

$$\underline{\underline{\oint_L \bar F\bullet d\bar l = \pi \text{ (pans)} = 3.1416 \text{ (pans)}}} \quad \therefore$$