EE 340(01) Quiz 1

Name:

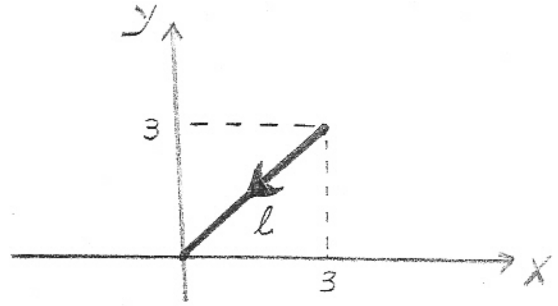
I.D. Number: KEY

a) Transform the following vector to cylindrical coordinates:

$$\vec{A} = 2y\vec{a}_x - \vec{a}_y + 3x\vec{a}_z$$

b) Express the vector $\vec{a}_r$ in rectangular coordinates, at the point P=P(0,0,5).

c) Evaluate $I = \int_l \vec{A}.\vec{dl}$, for $\vec{A} = 2(x-1)y\vec{a}_x - z\vec{a}_z$, over the path shown below:



a)
$$\begin{bmatrix} A_\rho \\ A_\phi \\ A_z \end{bmatrix} = \begin{bmatrix} \cos\phi & +\sin\phi & 0 \\ -\sin\phi & \cos\phi & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} A_x \\ A_y \\ A_z \end{bmatrix}$$

$$\therefore A_\rho = 2y\cos\phi - \sin\phi = 2\rho\sin\phi\cos\phi - \sin\phi$$

$$A_\phi = -2y\sin\phi - \cos\phi = -2\rho\sin^2\phi - \cos\phi$$

$$A_z = 3x = 3\rho\cos\phi$$

$$\therefore \vec{A} = (2\rho\sin\phi\cos\phi - \sin\phi)\vec{a}_\rho - (2\rho\sin^2\phi + \cos\phi)\vec{a}_\phi + 3\rho\cos\phi\,\vec{a}_z$$

b) $\vec{a}_r = \vec{a}_z$ at P.

c) $I = \int A_x\,dx + \int A_y\,dy = \int A_x\,dx$ (because $A_y = 0$).

$$= \int_{x=3}^{0} 2(x-1)y\,dx \Big|_{y=x} = \int_3^0 2(x-1)x\,dx = -9$$