EE230 Homework Assignment #1

Due Date: April 13, 2013
Submit your solutions to room called as YEMMER till 17.00

1. Find the rate at which the scalar field $V = r^2 \sin(2\emptyset)$ in cylindrical coordinates increases in the direction specified by the vector $\bar{L} = \hat{a}_r + \hat{a}_\emptyset$ at the point $\left(2, \frac{\pi}{3}, 0\right)$.

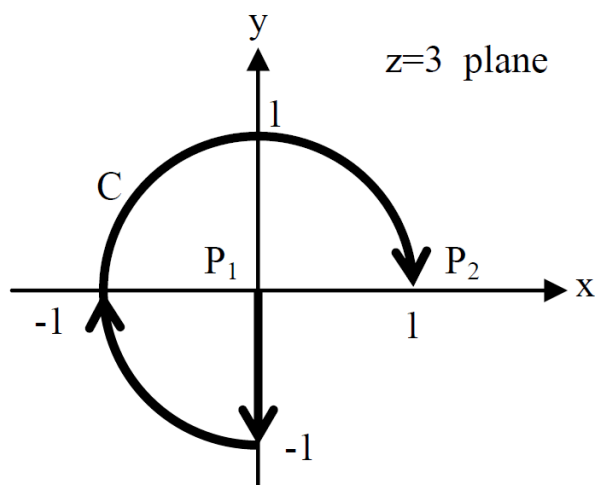2. A vector field, $\bar{F}$, is defined with the following expression:
$$\bar{F} = \hat{a}_x + \hat{a}_y z^4 + \hat{a}_z(4yz^3 + 5)$$

a) Determine the divergence of $\bar{F}$
b) Determine the curl of $\bar{F}$
c) Find $\int_c \bar{F} \cdot \overline{d\ell}$

where the contour C is defined from point P1 = (0,0,3) to point P2 = (1,0,3) as shown in the figure.

y

z=3 plane

1

C

P_1

P_2

x

-1

1

-1

3. Consider the vector field $\bar{A} = (x^2 + y^2)\hat{a}_z$ and the conical region shown in the figure.

a) Verify the Divergence Theorem for the given geometry.
b) Is this vector field expressible as the gradient of some scalar field ? Support your answer.
c) Is this vector field expressible as the curl of another vector field ? Support your answer.

z

a

α

y

x