

## Lab problems for 12/2/16

### Question1

Find curl and divergence of vector fields given below:

a)  $\vec{Q} = [x^2y, y^2z, x^2yz]$ .

b)  $\vec{Q} = [xy^2z, \cos y, y^2 \sin z]$ .

### Question2

(a) Determine and Plot Contours of a Scalar Field and Plot a Vector Distribution of the Associated Gradient Field. Choosing the scalar field  $F(x,y) = xe^{-(x^2+y^2)}$ , over the domain  $-2 < (x, y) < 2$ .

(b) Calculate and Plot the Divergence and Curl of a Vector Field by Choosing the vector field  $\vec{F} = -x^2\hat{i} + 2y^2\hat{j}$  over the domain  $-2 < (x, y) < 2$ .

### Question3

(a) Let  $\vec{D} = 2\rho z^2 a_\rho + \rho \cos(\phi)^2 a_z$  Evaluate

(i).  $\oint_S \vec{D} \cdot d\vec{s}$  (ii).  $\oint_V \nabla \cdot \vec{D} dv$

over the region defined by  $2 \leq \rho \leq 5$ ,  $-1 \leq z \leq 1$ ,  $0 \leq \phi \leq 2\pi$ .

(b) calculate the Laplacian of a given scalar field function  $\phi$ , and make appropriate three-dimensional plots of each distribution over the domain of interest. The scalar function is specified by  $\phi = x^2 + y^2$  over the domain  $-4 < (x, y) < 4$ .

### Question4

Is the vector field  $\vec{F} = xe^x\hat{i} + y\sin(z)\hat{j} + y^2e^z\hat{k}$  is conservative or not ?