1st Assignment
Subject : Physics II (Electrodynamics)
Date: 13th March 2017

1 **Sketch the following vector fields and find out divergence and curl of these vector fields**

$$\vec{V} = y\hat{i} + x\hat{j}\ ,\ \vec{V} = y\hat{i} - x\hat{j}\ ,\ \vec{V} = \frac{x}{\sqrt{x^2+y^2}}\hat{i} + \frac{y}{\sqrt{x^2+y^2}}\hat{j}$$

2 Check the fundamental theorem for gradients, using $T = x^2 + 4xy + 2yz^3$, the points $\mathbf{a} = (0, 0, 0)$, $\mathbf{b} = (1, 1, 1)$, and the three paths in Fig.

(a) $(0, 0, 0) \rightarrow (1, 0, 0) \rightarrow (1, 1, 0) \rightarrow (1, 1, 1)$;

(b) $(0, 0, 0) \rightarrow (0, 0, 1) \rightarrow (0, 1, 1) \rightarrow (1, 1, 1)$;

(c) the parabolic path $z = x^2$; $y = x$.

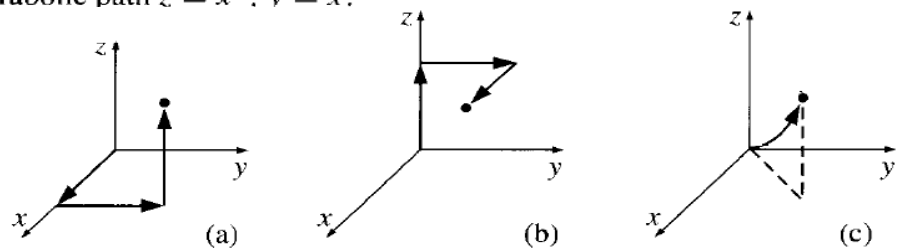

Fig.1

3. Evaluate the line integral $I = \int_C \vec{a} \cdot d\vec{l}$ where a = $(x + y)\mathrm{i} + (y - x)\mathrm{j}$, along each of the paths in the *xy*-plane shown in the figure below, namely,
1. the parabola $y^2 = x$ from (1; 1) to (4; 2),
2. the curve $x = 2u^2 + u + 1$, $y = 1 + u^2$ from (1; 1) to (4; 2),
3. the line from (1; 1) to (4; 1), followed by the line from (4; 1) to (4; 2).