Assignment II: Math for Eng II
Year I: CSE, CS, IS, IT,)

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Q.1. Use Laplace transform to solve the following system of first order ordinary differential equations

$$\begin{cases} x' = 2y - 2x + e^{-t} \\ y' = x - 3y \end{cases}$$

Q.2. Evaluate the following integrals
a)

$$\int_D \int \ln(x^2 + y^2) \mathrm{d}A$$

where $D = \{(x, y) : x^2 + y^2 = e \text{ and } x^2 + y^2 = 4\}$ **(3 marks)**
b)

$$\int_0^1 \int_0^1 \int_0^2 (x^2 + y^2)(9 - z^3) \mathrm{d}z\mathrm{d}y\mathrm{d}x$$

Q.3. Evaluate the following line integral

$$\int_{(1,0)}^{(0,1)} -y\mathrm{d}x + x\mathrm{d}y$$

along the quarter-circle given by the parametric equations $x = \cos t$ and $y = \sin t$
Q.4. a) Show that the divergence of the curl of any vector function $F(x, y, z)$ is zero i.e $\nabla(\nabla \times F) = 0$
b) Find the directional derivative and the maximum rate of change of the function $f(x, y, z) = x^2yz^2$ at the point $(1, 2, 3)$ in the direction of the vector $(-2, 3, -6)$.
c) Find the value of the constant λ such that the vector field defined by $\boldsymbol{F} = (2x^2y^2 + z^2)\mathbf{i} + (2xy^3 - x^2z)\mathbf{j} + (\lambda xy^2z + xy)\mathbf{k}$
is a solenoidal coil. Compute the curl of that vector field $\boldsymbol{F}$