Lagrange Multiplier

$$\begin{cases} \nabla f(x_m, y_m) = \lambda \nabla G(x_m, y_m) \\ S(x,y) = x^2 + y^2 \end{cases}$$

↗ bivariate

Q1 $f(x,y) = xe^y + y^2$

Sol: B

$\left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$

$\nabla f = \{e^y, xe^y + 2y\}$

$\nabla f(1,1) = \{e, 2\}$

$\frac{e+2}{\sqrt{2}}$ Sol: B

Q2) $x(t) = \frac{3t^2}{2}$ $\quad a \le t \le b$

$y(t) = t^3$

A) $\left\{\left(\frac{3}{2}\right)^{4/3}\right\} \left(3^{1/3} - 1\right)^{\frac{3}{2}} \Big\} \rightarrow \left\{\frac{3}{2}\left(4^{1/3} - 1\right)\right\}$

6)

$$\left\{\frac{3}{2}\left(3^{2/3}-1\right),\left(3^{2/3}-1\right)^{3/2}\right\} \to \{$$

C

Q3:

spherical Coord

$$0 \le r \le 1$$
$$0 \le \phi \le \pi$$
$$0 \le \theta \le 2\pi$$

$$x = r \sin\phi \cos\theta$$

$$y = r \sin\phi \sin\theta$$

$$z = r\cos\phi$$

$$dV = r \sin\phi \, dr \, d\phi \, d\theta$$

$$\iiint x^3 + xz^2 + zx^2 - y^2 \, dV$$

$$\Rightarrow r^3 \sin^3\phi \cos^3\theta + r^2\cos^2\phi \, r \sin\phi \cos\theta + 2r \sin\phi \cos\theta$$

$$x^3 + xz^2 + zx^2 - y^2$$

E)

Q4)