

(9.) for the scalar
$$f^n f(u,y,z) = u^2 + 3y^2 + 2z^2$$
 than gradient at point $\rho(1,2,-1)$

$$\Rightarrow \nabla f = \frac{\partial f}{\partial x} \hat{i} + \frac{\partial f}{\partial y} \hat{j} + \frac{\partial f}{\partial z} \hat{k}$$

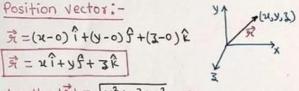
$$\Rightarrow 2x \hat{i} + 6y \hat{j} + 4z \hat{k}$$

$$\nabla f \Big|_{1,2,-1} = 2\hat{i} + 12\hat{j} - 4\hat{k}$$

$$\Rightarrow \nabla \cdot \vec{F} = \frac{\partial}{\partial x} u^3 y - \frac{\partial}{\partial y} u^2 y^2 + \frac{\partial}{\partial 3} (-u^2 y_3)$$

$$\Rightarrow \nabla \times \vec{F} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ yz & xz & xy \end{vmatrix} \Rightarrow 0$$

· Position vector:-



①
$$\frac{\partial \pi}{\partial u} = \frac{u}{\pi}$$
 froof: $\frac{\partial \pi}{\partial u} = \frac{\partial}{\partial x} \sqrt{u^2 + y^2 + z^2} \Rightarrow \frac{\partial x}{\partial x} = \frac{x}{\pi}$

$$\begin{array}{c|c}
\hline
0 & \frac{\partial x}{\partial y} = \frac{y}{\pi} & \boxed{0} & \nabla \cdot \vec{x} = \mathfrak{D}i \vee \vec{x} = 3 \\
\hline
0 & \nabla \times \vec{x} = \text{curl } \vec{x} = 0
\\
\hline
0 & \nabla \times \vec{x} = \text{curl } \vec{x} = 0
\\
\hline
0 & \nabla f \pi = f(\pi) \vee \pi
\\
\hline
0 & \nabla f \pi = \frac{\vec{x}}{\pi} & \boxed{0} & \nabla f \pi = \frac{1}{2} \\
\hline
0 & \nabla f \pi = \frac{\vec{x}}{\pi} & \frac{\vec{x}}{\pi} \Rightarrow \frac{\vec{x}}{\pi} \Rightarrow \frac{\vec{x}}{\pi}
\end{array}$$

$$\begin{array}{c|c}
\hline
0 & \nabla \cdot \vec{x} = \mathfrak{D}i \vee \vec{x} = 3
\\
\hline
0 & \nabla f \pi = f(\pi) \vee \pi
\\
\hline
0 & \nabla f \pi = \frac{1}{2} \times \nabla \pi \Rightarrow \frac{1}{2} \times \frac{\vec{x}}{\pi} \Rightarrow \frac{\vec{x}}{\pi}
\end{array}$$

$$\begin{array}{c|c}
\hline
0 & \nabla f \pi = f(\pi) \vee \pi
\\
\hline
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\end{array}$$

$\nabla^2 = \nabla \nabla = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2} \Rightarrow \nabla^2 f = 0$

$$3x^{2} + 3y^{2} + 3z^{2}$$

$$7^{2}f(x) = f''(x) + \frac{2}{x}f'(x)$$

1)
$$\nabla \cdot \mathfrak{R}^n \vec{\mathfrak{R}} = 0$$
 than, $n = -3$ $\nabla \cdot \frac{\vec{\mathfrak{R}}}{3} = 0$

· Property: -[2 operator together]

· NOTE:-

① unit surface normal vector (
$$\hat{N}$$
) = $\frac{\nabla f}{|\nabla f|}$

(9)
$$f = x^3 - y^3 + x^2 + x^3 + x^$$

$$\mathcal{D} = \Delta t \cdot \frac{|d|}{d}$$

•
$$DD_{mqx} = At \cdot \frac{\Delta t}{\Delta t} = \frac{|\Delta t|}{|\Delta t|} = |\Delta t|$$

$$\Rightarrow \int_{-\infty}^{2} \left(\frac{\chi^{2}}{2} \right) y \right]^{1} dy \Rightarrow 1 \underline{Ans}$$

$$\Rightarrow \int_{2}^{2} dy \Rightarrow \left[\frac{y^{2}}{4}\right]^{2} \Rightarrow 1 \text{ Ans} \quad \text{order of integration} \\ \text{doesn't matter.}$$

@ Variable limit:-

(9.)
$$\int_{0}^{1} \int_{0}^{x} uy \, dy \, dx \Rightarrow \text{Initial limit} \Rightarrow \begin{cases} x = 0 & x = 1 \\ y = 0 & y = x \end{cases}$$

$$\Rightarrow \int_{0}^{4} u \left[\frac{y^{2}}{2} \right]^{x} dx$$

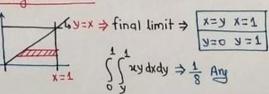
$$\Rightarrow \int_{0}^{4} u \cdot \frac{u^{2}}{3} dx$$

$$\Rightarrow \left[\frac{x^{+}}{8} \right]^{4} = \frac{1}{8} \text{ Ans}$$

$$(0,0) \qquad x=1$$

$$\Rightarrow \left[\frac{x^{+}}{8}\right]^{1} = \frac{1}{8} \underline{\text{Ans}}$$

change of order :-



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