

Section-2

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① $\phi = 3x^2y - y^3z$, find $\nabla \cdot \phi$ at point $(4, -2, -1)$

Soln = $\phi = 3x^2y - y^3z$

$$\nabla = \left(\frac{\partial}{\partial x} i + \frac{\partial}{\partial y} j + \frac{\partial}{\partial z} k \right)$$

$$\nabla \cdot \phi = \left(\frac{\partial}{\partial x} i + \frac{\partial}{\partial y} j + \frac{\partial}{\partial z} k \right) \cdot (3x^2y - y^3z)$$

$$\Rightarrow i \frac{\partial}{\partial x} (3x^2y - y^3z) + j \frac{\partial}{\partial y} (3x^2y - y^3z) + k \frac{\partial}{\partial z} (3x^2y - y^3z)$$

$$\frac{\partial}{\partial z} (3x^2y - y^3z)$$

$$\Rightarrow i(6xy) + j(3x^2 - 3y^2z) + k(-3y^2)$$

Now, putting the value $(1, -2, -1)$ in the above eqⁿ - ① we get,

$$i(6 \times 1 \times (-2)) + j(3 \times (1)^2 - 3(-2)^2(-1)) + k(-3(-2)^2)$$

$$\Rightarrow -12i + 15j - 12k$$