

## Section - 2

Ans-1

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

grad  $\phi$  at point  $(1, -2, -1)$

Here,  $\phi = 3x^2y - y^3z^2$

$$\frac{\partial \phi}{\partial x} = 6xy, \quad \frac{\partial \phi}{\partial y} = 3x^2 - 3y^2z^2,$$

$$\frac{\partial \phi}{\partial z} = -2y^3z$$

$$\therefore \text{grad } \phi = \nabla \phi = \hat{i} \frac{\partial \phi}{\partial x} + \hat{j} \frac{\partial \phi}{\partial y} + \hat{k} \frac{\partial \phi}{\partial z}$$

$$= 6xy\hat{i} + (3x^2 - 3y^2z^2)\hat{j} + (-2y^3z)\hat{k}$$

$$= -12\hat{i} - 9\hat{j} - 16\hat{k} \quad \text{at } (1, -2, -1)$$