$\frac{d}{dt}$ ... has a constant direction

=> If φ represent the potential then the level surface are called equipotential

=> If φ " the temperature then the level surface isothermal

$$\nabla = \frac{\partial}{\partial x} i + \frac{\partial}{\partial y} j + \frac{\partial}{\partial z} K$$

$\text{grad}\,\varphi = \nabla\varphi$
$= \frac{\partial\varphi}{\partial x} i + \frac{\partial\varphi}{\partial y} j + \frac{\partial\varphi}{\partial z} K$

∇ is gradiant, divergence and curl

Gradiant of a scalar function

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

Properties

(i) $\nabla(C\varphi) = C(\nabla\varphi)$ (ii) $\nabla(\varphi^n) = n\varphi^{n-1}\nabla\varphi$

(iii) $\nabla(\varphi + \psi) = \nabla\varphi \pm \nabla\psi$ (iii) $\nabla(\varphi\psi) = \varphi\nabla\psi + \psi\nabla\varphi$

(iv) $\nabla\left(\frac{\varphi}{\psi}\right) = \frac{\psi\nabla\varphi - \varphi\nabla\psi}{(\psi)^2}$

$\nabla\varphi . a$ is called the directional derivative of φ in the direction $\vec{a}$

(i) $\nabla f(r) = \frac{f'(r)\,\vec{r}}{r}$ (iii) $\nabla r = \hat{r}$

(iv) $\nabla\left(\frac{1}{r}\right) = \frac{-r}{-r^3}$

(ii) $\nabla r^n = n r^{n-2}\, r$

=> $\nabla . A$ is a divergence of a vector point function

$\nabla . A$ is scalar quantity then

$\nabla . A \neq A . \nabla$

=> If A is a constant vector then $\nabla . A = 0$