* $\nabla = \vec{i}\frac{\partial}{\partial x} + \vec{j}\frac{\partial}{\partial y} + \vec{k}\frac{\partial}{\partial z}$

* Laplacian operator $\nabla^2 = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2}$

* $\vec{A}\times(\vec{B}\times\vec{C}) = (\vec{A}\cdot\vec{C})\vec{B} - (\vec{A}\cdot\vec{B})\vec{C}$

* $[\vec{A}\ \vec{B}\ \vec{C}] = \vec{A}\cdot(\vec{B}\times\vec{C}) = \vec{B}\cdot(\vec{C}\times\vec{A}) = [\vec{B}\ \vec{C}\ \vec{A}]$
$= \vec{C}\cdot(\vec{A}\times\vec{B}) = [\vec{C}\ \vec{A}\ \vec{B}]$

* Grad $\phi = \nabla\phi = \left(\vec{i}\frac{\partial}{\partial x} + \vec{j}\frac{\partial}{\partial y} + \vec{k}\frac{\partial}{\partial z}\right)\phi$
$= \vec{i}\frac{\partial\phi}{\partial x} + \vec{j}\frac{\partial\phi}{\partial y} + \vec{k}\frac{\partial\phi}{\partial z} = \sum \vec{i}\frac{\partial\phi}{\partial x}$

* Div $\vec{F} = \nabla\cdot\vec{F} = \left(\vec{i}\frac{\partial}{\partial x} + \vec{j}\frac{\partial}{\partial y} + \vec{k}\frac{\partial}{\partial z}\right)\cdot\vec{F}$
$= \vec{i}\cdot\frac{\partial\vec{F}}{\partial x} + \vec{j}\cdot\frac{\partial\vec{F}}{\partial y} + \vec{k}\cdot\frac{\partial\vec{F}}{\partial z}$
$= \sum \vec{i}\cdot\frac{\partial\vec{F}}{\partial x}$

* curl $\vec{F} = \nabla\times\vec{F} = \left(\vec{i}\frac{\partial}{\partial x} + \vec{j}\frac{\partial}{\partial y} + \vec{k}\frac{\partial}{\partial z}\right)\times\vec{F}$
$= \vec{i}\times\frac{\partial\vec{F}}{\partial x} + \vec{j}\times\frac{\partial\vec{F}}{\partial y} + \vec{k}\times\frac{\partial\vec{F}}{\partial z}$

* Conservative field

A vector function $\vec{F}$ is called conservative field if

$$\int_{P_1}^{P_2} \vec{F} \cdot d\vec{r}$$ is independent of the path joining P_1 and P_2.

$\therefore$ $\boxed{\vec{F} = \nabla \phi}$

* The necessary and sufficient condition that a field be conservative is that

$\boxed{\text{curl } \vec{F} = \vec{0}}$

* If curl $\vec{F} = \vec{0}$ then F is irrotational.