Anexos

$\vec{E} = \frac{1}{4\pi\epsilon_0}\int \frac{(r-r')\rho(r')}{|r-r'|^3}dV$, $Q = \int_C \lambda dl$, $\vec{F} = Q\vec{E}$, $\nabla \times \vec{E} = 0$

$\oint_S \vec{E}\cdot\vec{n}da = \frac{Q_{enc}}{\epsilon_0}$, $\vec{F} = \frac{q}{4\pi\epsilon_0}\int \frac{(r-r')\rho(r')}{|r-r'|^3}dV$, $\varphi = -\int \vec{E}\cdot dl$, $\sigma = -\epsilon_0\frac{\partial\varphi}{\partial n}$

$\vec{E} = -\nabla\varphi$, $\int_S(\nabla\times\vec{F})\cdot\hat{n}da = \oint_C \vec{F}\cdot dl$, $W = \int_a^b \vec{F}\cdot dl$, $\nabla\cdot\vec{E} = \frac{\rho}{\epsilon_0}$

$\int_V(\nabla\cdot\vec{F})dV = \oint_S \vec{F}\cdot\hat{n}da$, $W = \frac{\epsilon_0}{2}\int_V E^2 dV$, $\nabla^2\varphi = -\frac{\rho}{\epsilon_0}$, $\varphi(r) = \frac{1}{4\pi\epsilon_0}\frac{q}{r}$

$\vec{P} = \chi\vec{E}$, $\vec{D} = \epsilon\vec{E}$, $\epsilon = \epsilon_0 + \chi$, $K = \epsilon/\epsilon_0$

$\sigma_p = \vec{n}\cdot\vec{P}$, $\vec{D} = \epsilon_0\vec{E} + \vec{P}$, $\vec{P} = \Delta\vec{p}/\Delta V$, $\rho_P = -\nabla\cdot\vec{P}$

$\vec{p_m} = \alpha\vec{E_m}$ $\varphi = \frac{1}{4\pi\epsilon_0}\frac{\vec{p}\cdot\hat{r}}{r^2}$, $\vec{J} = g\vec{E}$ $R = \frac{l}{gA} = \frac{l\eta}{A}$

$U = \frac{1}{2}Q\Delta\varphi$ $C = \frac{\epsilon A}{d}$ $F_x = -\left(\frac{\partial U}{\partial x}\right)_Q$ $F_x = +\left(\frac{\partial U}{\partial x}\right)_\varphi$

$\vec{J} = \sum N_i q_i \vec{v}_i$ $U = \frac{1}{2}\int \rho(r)\varphi(r)dv + \frac{1}{2}\int \sigma(r)\varphi(r)da$ $\nabla\cdot\vec{J} + \frac{\partial\rho}{\partial t} = 0$

$$\vec{E}_{dip} = \frac{1}{4\pi\epsilon_0}\left[\frac{3(r-r')\cdot\vec{p}(r-r')}{(r-r')^5} - \frac{\vec{p}}{(r-r')^3}\right]$$

Grad, Div, Curl and the Laplacian

	Cartesian Coordinates	Cylindrical Coordinates	Spherical Coordinates
Conversion to Cartesian Coordinates		$x = \rho\cos\varphi \quad y = \rho\sin\varphi \quad z = z$	$x = r\cos\varphi\sin\theta \quad y = r\sin\varphi\sin\theta \quad z = r\cos\theta$
Vector A	$A_x\boldsymbol{i} + A_y\boldsymbol{j} + A_z\boldsymbol{k}$	$A_\rho\hat{\boldsymbol{\rho}} + A_\varphi\hat{\boldsymbol{\varphi}} + A_z\hat{\boldsymbol{z}}$	$A_r\hat{\boldsymbol{r}} + A_\theta\hat{\boldsymbol{\theta}} + A_\varphi\hat{\boldsymbol{\varphi}}$
Gradient $\nabla\phi$	$\frac{\partial\phi}{\partial x}\boldsymbol{i} + \frac{\partial\phi}{\partial y}\boldsymbol{j} + \frac{\partial\phi}{\partial z}\boldsymbol{k}$	$\frac{\partial\phi}{\partial\rho}\hat{\boldsymbol{\rho}} + \frac{1}{\rho}\frac{\partial\phi}{\partial\varphi}\hat{\boldsymbol{\varphi}} + \frac{\partial\phi}{\partial z}\hat{\boldsymbol{z}}$	$\frac{\partial\phi}{\partial r}\hat{\boldsymbol{r}} + \frac{1}{r}\frac{\partial\phi}{\partial\theta}\hat{\boldsymbol{\theta}} + \frac{1}{r\sin\theta}\frac{\partial\phi}{\partial\varphi}\hat{\boldsymbol{\varphi}}$
Divergence $\nabla\cdot A$	$\frac{\partial A_x}{\partial x} + \frac{\partial A_y}{\partial y} + \frac{\partial A_z}{\partial z}$	$\frac{1}{\rho}\frac{\partial(\rho A_\rho)}{\partial\rho} + \frac{1}{\rho}\frac{\partial A_\varphi}{\partial\varphi} + \frac{\partial A_z}{\partial z}$	$\frac{1}{r^2}\frac{\partial(r^2A_r)}{\partial r} + \frac{1}{r\sin\theta}\frac{\partial A_\theta\sin\theta}{\partial\theta} + \frac{1}{r\sin\theta}\frac{\partial A_\varphi}{\partial\varphi}$
Curl $\nabla\times A$	$\begin{vmatrix} \boldsymbol{i} & \boldsymbol{j} & \boldsymbol{k} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ A_x & A_y & A_z \end{vmatrix}$	$\begin{vmatrix} \frac{1}{\rho}\hat{\boldsymbol{\rho}} & \hat{\boldsymbol{\varphi}} & \frac{1}{\rho}\hat{\boldsymbol{z}} \\ \frac{\partial}{\partial\rho} & \frac{\partial}{\partial\varphi} & \frac{\partial}{\partial z} \\ A_\rho & \rho A_\varphi & A_z \end{vmatrix}$	$\begin{vmatrix} \frac{1}{r^2\sin\theta}\hat{\boldsymbol{r}} & \frac{1}{r\sin\theta}\hat{\boldsymbol{\theta}} & \frac{1}{r}\hat{\boldsymbol{\varphi}} \\ \frac{\partial}{\partial r} & \frac{\partial}{\partial\theta} & \frac{\partial}{\partial\varphi} \\ A_r & rA_\theta & rA_\varphi\sin\theta \end{vmatrix}$
Laplacian $\nabla^2\phi$	$\frac{\partial^2\phi}{\partial x^2} + \frac{\partial^2\phi}{\partial y^2} + \frac{\partial^2\phi}{\partial z^2}$	$\frac{1}{\rho}\frac{\partial}{\partial\rho}\left(\rho\frac{\partial\phi}{\partial\rho}\right) + \frac{1}{\rho^2}\frac{\partial^2\phi}{\partial\varphi^2} + \frac{\partial^2\phi}{\partial z^2}$	$\frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2\frac{\partial\phi}{\partial r}\right) + \frac{1}{r^2\sin\theta}\frac{\partial}{\partial\theta}\left(\sin\theta\frac{\partial\phi}{\partial\theta}\right) + \frac{1}{r^2\sin^2\theta}\frac{\partial^2\phi}{\partial\varphi^2}$

The End.