Cylindrical $\nabla\times\mathbf{A}=\left[\frac{1}{s}\frac{\partial A_z}{\partial\phi}-\frac{\partial A_\phi}{\partial z}\right]\hat{\mathbf{s}}+\left[\frac{\partial A_s}{\partial z}-\frac{\partial A_z}{\partial s}\right]\hat{\phi}+\frac{1}{s}\left[\frac{\partial(sA_\phi)}{\partial s}-\frac{\partial A_s}{\partial\phi}\right]\hat{\mathbf{z}}$ $\quad \vec{\nabla}f=\hat{\mathbf{s}}\frac{\partial f}{\partial s}+\hat{\phi}\frac{1}{s}\frac{\partial f}{\partial\phi}+\hat{\mathbf{z}}\frac{\partial f}{\partial z}$

$\nabla\cdot\mathbf{A}=\frac{1}{s}\frac{\partial(sA_s)}{\partial s}+\frac{1}{s}\frac{\partial A_\varphi}{\partial\varphi}+\frac{\partial A_z}{\partial z}$ $\quad d\tau = s\,ds\,d\phi\,dz \quad da = s\,d\phi\,dz \quad d\boldsymbol{l} = ds\,\hat{\boldsymbol{s}} + s\,d\phi\,\hat{\boldsymbol{\phi}} + dz\,\hat{\boldsymbol{z}}$

$\nabla^2 V=\frac{1}{s}\frac{\partial}{\partial s}\left(s\frac{\partial V}{\partial s}\right)+\frac{1}{s^2}\frac{\partial^2 V}{\partial\phi^2}+\frac{\partial^2 V}{\partial z^2}$ $\quad d\boldsymbol{l} = dr\,\hat{\boldsymbol{r}} + r\,d\theta\,\hat{\boldsymbol{\theta}} + r\sin\theta\,d\phi\,\hat{\boldsymbol{\phi}}$

Polar (2d) $da = r\,dr\,d\theta$

Spherical $\vec{\nabla}=\hat{r}\frac{\partial f}{\partial r}+\hat{\theta}\frac{1}{r}\frac{\partial f}{\partial\theta}+\hat{\phi}\frac{1}{r\sin\theta}\frac{\partial f}{\partial\phi}$ $\quad da = r^2\,d\theta\,\sin\theta\,d\phi \quad d\tau = dr\,da = r^2\,dr\,d\theta\,\sin\theta\,d\phi$

$\nabla\times\mathbf{A}=\frac{1}{r\sin\theta}\left[\frac{\partial}{\partial\theta}\sin\theta A_\phi-\frac{\partial A_\theta}{\partial\phi}\right]\hat{\mathbf{r}}+\frac{1}{r}\left[\frac{1}{\sin\theta}\frac{\partial A_r}{\partial\phi}-\frac{\partial}{\partial r}(rA_\phi)\right]\hat{\theta}+\frac{1}{r}\left[\frac{\partial(rA_\theta)}{\partial r}-\frac{\partial A_r}{\partial\theta}\right]\hat{\phi}$

$\nabla\cdot\mathbf{A}=\frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2A_r\right)+\frac{1}{r\sin\theta}\frac{\partial}{\partial\theta}\left(\sin\theta\,A_\theta\right)+\frac{1}{r\sin\theta}\frac{\partial A_\phi}{\partial\phi}$ $\quad \nabla^2 V=\frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2\frac{\partial V}{\partial r}\right)+\frac{1}{r^2\sin\theta}\frac{\partial}{\partial\theta}\left(\sin\theta\frac{\partial V}{\partial\theta}\right)+\frac{1}{r^2 sin^2\theta}\frac{\partial^2 V}{\partial\theta^2}$

Cartesian $\nabla\cdot\mathbf{A}=\frac{\partial A_x}{\partial x}+\frac{\partial A_y}{\partial y}+\frac{\partial A_z}{\partial z}$ $\quad \vec{\nabla}f=\hat{\mathbf{x}}\frac{\partial f}{\partial x}+\hat{\mathbf{y}}\frac{\partial f}{\partial y}+\hat{\mathbf{z}}\frac{\partial f}{\partial z}$ $\quad \nabla\times\mathbf{A}=\begin{vmatrix}\hat{x} & \hat{y} & \hat{z}\\ \partial/\partial x & \partial/\partial y & \partial/\partial z\\ A_x & A_y & A_z\end{vmatrix}$ $\quad d\tau = dx\,dx\,dz$

$d\boldsymbol{l} = dx\,\hat{\mathbf{x}} + dy\,\hat{\mathbf{y}} + dz\,\hat{\mathbf{z}}$ $\quad Laplacian\ \nabla^2 V=\nabla\cdot(\nabla V)$

Electrostatics $\mathbf{E}=\frac{q}{4\pi\varepsilon_0}\frac{\hat{\mathbf{r}}}{r^2}$ $\quad \nabla^2 V=-\frac{\rho}{\varepsilon_0}$ $\quad \mathbf{E}=-\nabla V$ $\quad \mathbf{E}=\frac{1}{4\pi\varepsilon_0}\int\frac{\hat{\zeta}}{\zeta^2}\rho(r')d\tau'\ where\ \vec{\zeta}=\mathbf{r}-\mathbf{r}'$

$V(\mathbf{r})=\frac{1}{4\pi\varepsilon_0}\int_{surface}\frac{\sigma(\mathbf{r}')}{|\mathbf{r}-\mathbf{r}'|}da'$ $\quad V(\mathbf{r})=\frac{1}{4\pi\varepsilon_0}\int_{volume}\frac{\rho(\mathbf{r}')}{|\mathbf{r}-\mathbf{r}'|}d\tau'$ $\quad V(r,\theta)=\sum_{l=0}^{\infty}\left(A_l r^l+\frac{B_l}{r^{l+1}}\right)P_l(\cos\theta)$

$\nabla^2 V=0\Rightarrow\frac{1}{X}\frac{d^2X}{dx^2}+\frac{1}{Y}\frac{d^2Y}{dy^2}+\frac{1}{Z}\frac{d^2Z}{dz^2}=0$ $\quad dq = \rho\,d\tau = \sigma\,da = \lambda\,dx$ $\quad W=\frac{\varepsilon_0}{2}\int_{all\,space}E^2 d\tau$

Gauss's Law: $\nabla\cdot\mathbf{E}=\frac{\rho}{\varepsilon_0}$ $\quad V(r_b)-V(r_a)=-\int_{r_a}^{r_b}\mathbf{E}\cdot d\mathbf{l}$ $\quad E_\perp^{above}-E_\perp^{below}=\frac{\sigma}{\varepsilon_0}$

Magnetostatics $\boldsymbol{I}=\lambda\boldsymbol{v}$ $\quad \boldsymbol{K}=\sigma\boldsymbol{v}$ $\quad \boldsymbol{J}=\rho\boldsymbol{v}$ $\quad \boldsymbol{K}_b=\boldsymbol{M}\times\boldsymbol{n}$ $\quad \mathbf{J}_b=\text{curl}(\mathbf{M})$ $\quad \mathbf{B}=\nabla\times\mathbf{A}$ $\quad \mathbf{H}=\frac{\mathbf{B}}{\mu_0}-\mathbf{M}$ $\quad \nabla\times\mathbf{H}=\mathbf{J}_{free}$

$\mathbf{B}(\mathbf{r})=\frac{\mu_0}{4\pi}\int\frac{I\mathbf{d}\ell\times\hat{\zeta}}{\zeta^2}=\frac{\mu_0}{4\pi}\int\frac{\mathbf{J}\times\hat{\zeta}}{\zeta^2}d\tau\quad where\ \vec{\zeta}=\mathbf{r}-\mathbf{r}'$ $\quad \nabla^2\mathbf{A}=-\mu_0\mathbf{J}$ $\quad I_{enc}=\int\mathbf{J}\cdot d\mathbf{a}$

$\nabla\times\mathbf{B}=\mu_0\mathbf{J}\ \rightarrow\oint\mathbf{B}\cdot d\ell=\mu_0 I_{enc}$ $\quad \nabla\cdot\mathbf{B}=0$ $\quad \mathbf{B}_{dip}=\frac{\mu_0 m}{4\pi r^3}\left(2\cos\theta\,\hat{\mathbf{r}}+\sin\theta\,\hat{\theta}\right)$

$\mathbf{F}=Q\mathbf{v}\times\mathbf{B}$ $\quad d\mathbf{F}=I\,d\ell\times\mathbf{B}=da\,\mathbf{K}\times\mathbf{B}=d\tau\,\mathbf{J}\times\mathbf{B}$

Dipoles etc. $\mathbf{p}=\int_{volume}\mathbf{r}'\rho(\mathbf{r}')d\tau'=\sum_i\mathbf{r}_i q_i$ $\quad V(\mathbf{r})=\frac{1}{4\pi\varepsilon_0}\sum_{n=0}^{\infty}\frac{1}{r^{n+1}}\int_{volume}d\tau'(r')^n P_n(\cos(\theta'))\rho(\mathbf{r}')$ $\quad V_{dipole}(\mathbf{r})=\frac{1}{4\pi\varepsilon_0}\frac{\mathbf{p}\cdot\hat{\mathbf{r}}}{r^2}$

$\sigma_b=\mathbf{P}\cdot\hat{\mathbf{n}}$ $\quad \rho_b=-\nabla\cdot\mathbf{P}$ $\quad V(\boldsymbol{r})=\frac{1}{4\pi\varepsilon_0}\sum_{n=0}^{\infty}\frac{1}{r^{n+1}}\sum_{charges\ i}dq_i r_i^n P_n(\cos(\theta_i))$

$\mathbf{E}_{dip}=\frac{p}{4\pi\varepsilon_0 r^3}\left(2\cos\theta\,\hat{\mathbf{r}}+\sin\theta\,\hat{\theta}\right)$ $\quad \mathbf{N}=\mathbf{p}\times\mathbf{E}\ or\ \mathbf{N}=\mathbf{m}\times\mathbf{B},\ \mathbf{F}=\nabla(\mathbf{p}\cdot\mathbf{E})\ or\ \nabla(\mathbf{m}\cdot\mathbf{B})$

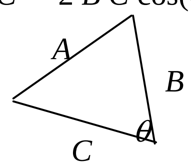
Linear dielectric: $\mathbf{P}=\chi_e\varepsilon_0\mathbf{E}$, where $\boldsymbol{p}=\mathbf{P}\,d\tau$

$\mathbf{D}=\varepsilon_0\mathbf{E}+\mathbf{P}$ $\quad \nabla\cdot\mathbf{D}=\rho_{free}$ $\quad \mathbf{P}=\varepsilon_0\chi_e\mathbf{E}\quad (linear\ dielectrics)$ $\quad \mathbf{D}=\varepsilon_0(1+\chi_e)\mathbf{E}=\varepsilon\mathbf{E}$

Theorems, constants, etc. $\varepsilon_0 = 8.85\times10^{-12}\ \mathrm{C^2/Nm^2}$ $\quad \mu_0 = 4\pi\times10^{-7}\ \mathrm{N/A^2}$ $\quad A^2 = B^2 + C^2 - 2BC\cos(\theta)$

Stokes Theorem → $\int(\nabla\times\mathbf{A})\cdot d\mathbf{a}=\oint\mathbf{A}\cdot d\mathbf{l}$ $\quad \int_{volume}\nabla\cdot\mathbf{A}\,d\tau=\oint_{surface}\mathbf{A}\cdot d\mathbf{a}$

$P_0(x)=1,\quad P_1(x)=x,\quad P_2(x)=\frac{1}{2}\left(3x^2-1\right),\quad\ldots$ $\quad$ Divergence Theorem



Some integrals.

$$\int_0^{\pi} d(\cos\theta) P_m(\cos\theta) P_l(\cos\theta) = \begin{matrix} 0 \; if \;\; m \neq l \\ \frac{2}{2m+1} \; if \;\; m = l \end{matrix}$$

$$\int \sin^3 x\, dx = \frac{-1}{3}\cos(x)(\sin^2 x + 2) \qquad \int \sin^4 x = \frac{3x}{8} - \frac{\sin(2x)}{4} + \frac{\sin(4x)}{32}$$

$$\int \frac{dx}{\left(x^2 + a^2\right)^{3/2}} = \frac{x}{a^2\sqrt{x^2 + a^2}} \qquad \int_0^a \sin(\frac{n\pi x}{a})\sin(\frac{m\pi x}{a})dx = \begin{matrix} 0 \quad if \;\; n \neq m \\ a/2 \;\; if \;\; n = m \end{matrix}$$

$$\int \sin(kx)dx = \frac{-1}{k}\cos(kx) \qquad \int \frac{\sin(\theta)d\theta}{\sqrt{1-\cos(\theta)}} = 2\sqrt{1-\cos(\theta)} \qquad \int \cos(kx)dx = \frac{1}{k}\sin(kx)$$