PHYS301 Electricity and Magnetism

Here are a few things that you should know – have committed to memory – for our first exam!

$$A \equiv \left|\vec{A}\right| = \left[A_x^2 + A_y^2 + A_z^2\right]^{1/2} \qquad \hat{A} = \vec{A}/A$$

$$\vec{A}\cdot\vec{B} = \sum_i A_i B_i = AB\cos\theta$$

$$\left|\vec{A}\times\vec{B}\right| = AB\sin\theta \text{ and } \vec{A}\times\vec{B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ A_x & A_y & A_z \\ B_x & B_y & B_z \end{vmatrix}$$

$$\hat{i} = \hat{x} = \hat{e}_1, \quad \hat{j} = \hat{y} = \hat{e}_2, \quad \hat{k} = \hat{z} = \hat{e}_3$$

$$\vec{r} = \hat{i}x + \hat{j}y + \hat{k}z \text{ in Cartesian coordinates}$$

$$\vec{\mathscr{r}} = \vec{r} - \vec{r}' \text{ and how to visualize it!}$$

$$\vec{\nabla} \equiv \hat{x}\frac{\partial}{\partial x} + \hat{y}\frac{\partial}{\partial y} + \hat{z}\frac{\partial}{\partial z}$$

$$\vec{\nabla}\cdot\vec{V}, \vec{\nabla}\times\vec{V}, \vec{\nabla}f \quad \text{[div, curl, \& grad] in Cartesian!}$$

$$d\vec{l} = \hat{x}dx + \hat{y}dy + \hat{z}dz$$

$$\text{Kronecker delta: } \delta_{ij} = \begin{cases} 0 \text{ if } i \neq j \\ 1 \text{ if } i = j \end{cases}$$

✓Levi-Civita symbol

The three fundamental theorems of vector calculus

✓Spherical & cylindrical coordinate variables & unit vectors +how to use them!

✓Dirac delta function: $\delta(x-a)$ & $\delta(\vec{r}-\vec{a})$

✓Curl-less field theorem & divergence-less field theorem

Coulomb's law and $\vec{F} = q\vec{E}$

Meanings of $\lambda(\vec{r})$, $\sigma(\vec{r})$, & $\rho(\vec{r})$

Maxwell's equations and the Lorentz force law

[✓indicates items that are okay to put on your 3 x 5 inch card]