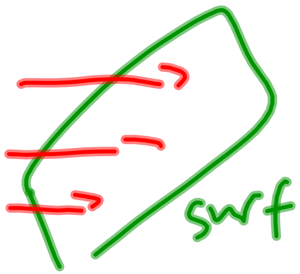
1. $$\underbrace{\oint \vec{E}\cdot d\vec{A}}_{\text{flux}} = \frac{Q_{in}}{\varepsilon_0}$$ Gauss's law

Φ_E electric field flux



surface

the amount of electric field passing through the surface => flux

$$d\Phi_E = \vec{E}\cdot d\vec{A}$$

if the flux is constant

$$\Phi_E = E\cdot A = \frac{Q_{in}}{\varepsilon_0}$$

$$E \cdot A = \frac{Q_{in}}{\varepsilon_0}$$

sphere $A = 4\pi r^2$

$$E \cdot 4\pi r^2 = \frac{Q_{in}}{\varepsilon_0}$$

$$\vec{E} = \frac{Q_{in}}{4\pi \varepsilon_0 r^2} \hat{r}$$

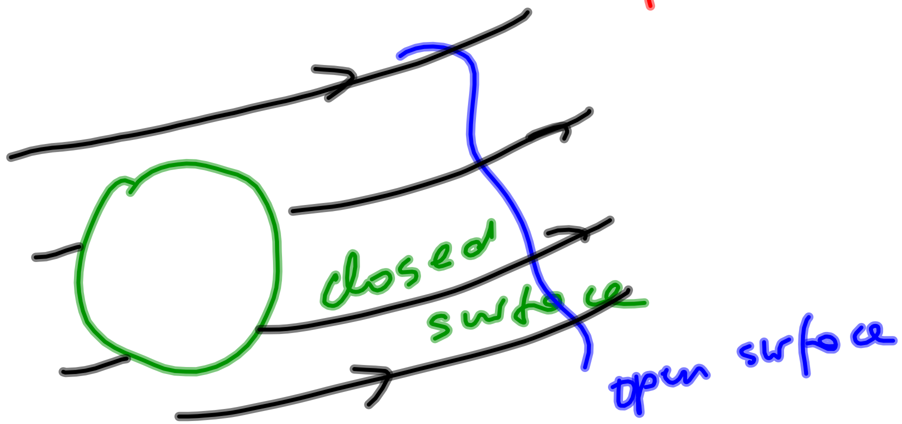
2. $\oint \vec{B} \cdot d\vec{A} = 0$ Gauss's law for magnetism

$\Phi_B = \oint \vec{B} \cdot d\vec{A}$ Φ_B magnetic field flux

if flux is ct

$\Phi_B = B \cdot A$

Flux through closed surface is zero



3. Faraday's law

An electric field can also be created by a changing magnetic field

$$\oint \vec{E} \cdot d\vec{s} = -\frac{d\Phi_B}{dt}$$