

$$\vec{F} = k \frac{q_1 q_2}{r_{12}^2} \hat{r}_{12} = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{r_{12}^2} \hat{r}_{12}$$

$$\phi_E = \oint \vec{E} \cdot d\vec{A}$$

$$\oint \vec{E} \cdot d\vec{A} = \frac{Q_{enc}}{\epsilon_0}$$

$$E_S = -dV/ds$$

$$V = W/q$$

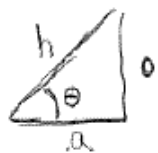
$$V_{prchg} = \frac{kq}{R}$$

$$\vec{E} = \int_{vol} \frac{k dQ}{r^2} dr \hat{r}$$

$$V = \int_{vol} \frac{k dQ}{r}$$

Sphere: $A = 4\pi r^2$
 $V = \frac{4}{3}\pi r^3$

Cylinder: $A = 2\pi rL + 2\pi r^2$
 $V = \pi r^2 L$



$$\sin \theta = \frac{a}{h}$$

$$\cos \theta = \frac{a}{h}$$

$$\tan \theta = \frac{O}{a}$$

$$\left. \begin{aligned} x' &= \gamma(x - vt) \\ y' &= y \\ z' &= z \\ t' &= \gamma(t - \frac{v}{c^2}x) \end{aligned} \right\} \text{Lorentz TRANS}$$

$$\gamma = \frac{1}{\sqrt{1 - (v/c)^2}}$$

$$\text{Const. Accel.} \begin{cases} v = v_0 + at \\ x = x_0 + v_0 t + \frac{1}{2} at^2 \\ v^2 = v_0^2 + 2a(x - x_0) \\ x^2 = x_0 + \frac{1}{2}(v_0 + v)t \end{cases}$$

$$a_c = \frac{mv^2}{R}$$

$$S = R\theta$$

$$KE = \frac{1}{2} m v^2$$

$$PE_{spring} = \frac{1}{2} k x^2$$

$$V_{prchg} = \frac{kq}{R}$$

$$U_{capacitor} = \frac{1}{2} CV^2$$

$$E_{//plate} = \sigma/\epsilon_0$$

$$U_E = \frac{\epsilon_0}{2} E^2$$

$$C_{tot} = \sum C_i \text{ (parallel)}$$

$$\frac{1}{C_{tot}} = \sum \frac{1}{C_i} \text{ (series)}$$

$$R_{tot} = \sum R_i \text{ (series)}$$

$$\frac{1}{R_{tot}} = \sum \frac{1}{R_i} \text{ (parallel)}$$

$$Q = CV$$

$$P = \frac{dU}{dt} = iV = i^2 R = \frac{V^2}{R}$$

$$V = iR$$

$$\vec{F} = q \vec{v} \times \vec{B} = i \vec{L} \times \vec{B}$$

$$|\vec{\mu}| = N i \vec{A}$$

$$\vec{\tau} = \vec{\mu} \times \vec{B}$$

$$\oint \vec{B} \cdot d\vec{l} = \mu_0 I_{enc}$$

$$B_{solenoid} = \mu_0 N i$$

$$d\vec{B} = \frac{\mu_0 i}{4\pi} \frac{d\vec{l} \times \hat{r}}{r^2}$$

$$E = -\frac{d\phi_B}{dt}$$

$$\phi = \oint \vec{B} \cdot d\vec{A}$$

$$\mathcal{E} = -L \frac{di}{dt}$$

$$\phi = Li$$

$$U_m = \frac{B^2}{2\mu_0}$$

$$Q = C\mathcal{E}(1 - e^{-t/RC})$$

$$Q = Q_0 e^{-t/RC}$$

$$E = E_0/\kappa$$

$$\left. \begin{array}{l} \int u^n du = \frac{u^{n+1}}{n+1} \\ \int \frac{du}{u} = \ln|u| \\ \int e^u du = e^u \\ \int \frac{x dx}{x^2+a^2} = \sqrt{x^2+a^2} \end{array} \right\} \text{Integrals}$$

$$\left. \begin{array}{l} e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots \\ \ln(1+x) = x - \frac{x^2}{2} + \frac{x^3}{3} + \dots \quad -1 < x < 1 \\ \ln x = \frac{x-1}{x} + \frac{1}{2} \left(\frac{x-1}{x}\right)^2 + \dots \quad x \geq \frac{1}{2} \\ (1+x)^{-1} = 1 - x + x^2 - x^3 + \dots \quad -1 < x < 1 \\ (1+x)^{-2} = 1 - 2x + 3x^2 - \dots \quad -1 < x < 1 \\ (1+x)^{1/2} = 1 + \frac{1}{2}x - \frac{x^2}{8} + \dots \quad -1 < x < 1 \end{array} \right\} \text{Taylor's Series expansions}$$