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

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

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

$$E_s = -\frac{dV}{ds}$$

$$V = \frac{W}{q}$$

$$V_{\text{at chg}} = \frac{kQ}{R}$$

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

$$\mathcal{U}_E = \frac{\epsilon_0}{2}E^2$$

$$E_{\parallel \text{plate cap}} = \frac{\sigma}{\epsilon_0}$$

$C = \sum C_i$ Parallel

$\frac{1}{C} = \sum \frac{1}{C_i}$ Series

$R = \sum R_i$ Series

$\frac{1}{R} = \sum \frac{1}{R_i}$ Parallel

$Q = CV$

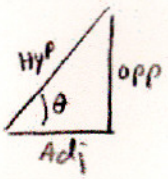
$$P = \frac{dU}{dt} = IV = I^2R = \frac{V^2}{R}$$

$E = E_0/K \quad C = KC_0$

$V = IR$

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

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



$\sin\theta = \frac{Opp}{Hyp}$

$\cos\theta = \frac{Adj}{Hyp}$

$\tan\theta = \frac{Opp}{Adj}$

Sphere

Area $= 4\pi r^2$

Volume $= \frac{4}{3}\pi r^3$

Cylinder

Area $= 2\pi rL + (2)\pi r^2$

Volume $= \pi r^2 L$

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

$\vec{\mu} = NI\vec{A}$

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

$$\oint \vec{B}\cdot d\vec{\ell} = \mu_0 I_{encl}$$

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

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

$$\mathcal{E} = -\frac{d\Phi_B}{dt} = -\frac{d}{dt}\int \vec{B}\cdot d\vec{A}$$

$$\Phi_B = \int \vec{B}\cdot d\vec{A}$$

$\mathcal{E}_1 = -L\frac{dI_2}{dt} \quad \Phi_1 = LI_2$

$\mathcal{E}_1 = -M\frac{dI_2}{dt} \quad \Phi_1 = MI_1$

$$\mathcal{U}_M = B^2/2\mu_0$$

Integrals

$$\int u^n du = \frac{u^{n+1}}{n+1}$$

$$\int \frac{du}{u} = \ln|u|$$

$$\int e^u du = e^u$$

$$\int \frac{x\,dx}{\sqrt{x^2+a^2}} = \sqrt{x^2+a^2}$$

Const Accel eqns

$v = v_0 + at$

$x = x_0 + v_0 t + \frac{1}{2}at^2$

$v^2 = v_0^2 + 2(a)(x - x_0)$

$x = x_0 + \frac{1}{2}(v_0 + v)t$

$v = \lambda\nu$

$n_1 \sin\theta_1 = n_2 \sin\theta_2$

$n = \frac{c}{v}$

$\frac{1}{i} + \frac{1}{o} = \frac{1}{F}$

$m = -i/o$

$d\sin\theta = m\lambda$

$\theta \sim 1.22\frac{\lambda}{D}$

$E = h\nu$

$\lambda = h/p$

$E_n = -\frac{Z^2 13.6\,ev}{n^2}$

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

$\Delta t' = \gamma\Delta t \qquad \Delta x' = \gamma\Delta x$