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

$$\phi_E = \oint \vec{E}\cdot\vec{dA}$$

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

$$E_S = -dV/ds$$

$$V = W/q$$

$$V_{pr\,chg} = \frac{kq}{R}$$

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

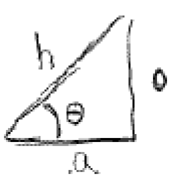
$$V = \int_{vol} \frac{k\,dQ}{r}$$

Sphere: $A = 4\pi r^2$

$V = 4/3\,\pi r^3$

cylinder: $A = 2\pi r L + 2\pi r^2$

$V = \pi r^2 L$



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

$$\cos\theta = a/h$$

$$\tan\theta = o/a$$

$|e| = 1.6\times10^{-19}$ Coulombs

$k = 8.99\times10^{9}\ m/F$

$\epsilon_0 = 8.85\times10^{-12}\ F/m$

Const. Accel.

$$\begin{cases} V = V_0 + at \\ X = X_0 + V_0 t + \frac{1}{2}at^2 \\ V^2 = V_0^2 + 2a(x - x_0) \\ X^2 = x_0 + \frac{1}{2}(V_0 + V)t \end{cases}$$

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

$$S = R\Theta$$

$$KE = \frac{1}{2}mv^2$$

$$PE_{spring} = \frac{1}{2}kx^2$$

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

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

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

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

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots$$

$$\ln(1+x) = x - \frac{x^2}{2} + \frac{x^3}{3} + \cdots \quad -1<x<1$$

$$\ln x = \frac{x-1}{x} + \frac{1}{2}\left(\frac{x-1}{x}\right)^2 + \cdots \quad x \geq \frac{1}{2}$$

$$(1+x)^{-1} = 1 - x + x^2 - x^3 + \cdots \quad -1<x<1$$

$$(1+x)^{-2} = 1 - 2x + 3x^2 - \cdots \quad -1<x<1$$

$$(1+x)^{1/2} = 1 + \frac{1}{2}x - \frac{x^2}{8} + \cdots \quad -1<x<1$$