

Physical Constants

$c = 2.998 \times 10^8 \text{ m/s}$	Speed of light
$\mu_0 = 4\pi \times 10^{-7} \text{ N/A}^2$ (or H/m)	Permeability constant in vacuum
$\epsilon_0 = \frac{1}{\mu_0 c^2} = 8.854 \times 10^{-12} \text{ C}^2/\text{Nm}^2$ (or F/m)	Permittivity constant in vacuum
$\frac{1}{4\pi\epsilon_0} = 10^{-7} c^2 = 8.988 \times 10^9 \text{ Nm}^2/\text{C}^2$	
$e = 1.602 \times 10^{-19} \text{ C}$	Magnitude of electron charge
$m_e = 0.9109 \times 10^{-30} \text{ kg}$	Electron mass

Useful Integrals

$$\int \frac{dx}{\sqrt{a^2 + x^2}} = \ln \left(x + \sqrt{a^2 + x^2} \right)$$

$$\int \frac{dx}{a^2 + x^2} = \frac{1}{a} \arctan \frac{x}{a}$$

$$\int \frac{dx}{(a^2 + x^2)^{3/2}} = \frac{x}{a^2 \sqrt{a^2 + x^2}}$$

Binomial expansion

$$(1 + \epsilon)^p = 1 + p\epsilon + \frac{p(p-1)}{2!} \epsilon^2 + \frac{p(p-1)(p-2)}{3!} \epsilon^3 + \dots$$

Notation for position vector

$$\mathbf{x} = \hat{\mathbf{i}}x + \hat{\mathbf{j}}y + \hat{\mathbf{k}}z$$

$$r = |\mathbf{x}| = \sqrt{x^2 + y^2 + z^2} \quad \text{and} \quad \hat{\mathbf{r}} = \frac{\mathbf{x}}{r}$$