

Useful Equations for Exam 1

Gravitation:

$$F_G = \frac{Gm_1m_2}{r^2}$$

$$G = 6.67 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2$$

$$\vec{g} = \frac{\vec{F}_G}{m}$$

$$U(r) = \frac{-GMm}{r}$$

Satellite in orbit:

$$\frac{T^2}{r^3} = \frac{4\pi^2}{GM}$$

$$v = \sqrt{G\frac{M}{r}}$$

$$K = +\frac{1}{2}G\frac{Mm}{r}$$

$$E_{mech} = K + U = -\frac{1}{2}G\frac{Mm}{r}$$

Electric Force and Electric Field:

$$F_E = \frac{kq_1q_2}{r^2}$$

$$k = 8.99 \times 10^9 \text{ N}\frac{\text{m}^2}{\text{C}^2} \approx 9 \times 10^9 \text{ N}\frac{\text{m}^2}{\text{C}^2}$$

$$e = 1.6 \times 10^{-19} \text{ C}$$

$$\epsilon_o = 8.85 \times 10^{-12} \text{ C}^2 / (\text{N}\cdot\text{m}^2)$$

$$\vec{E} = \frac{kQ}{r^2} \hat{r} \text{ electric field of point charge}$$

$$E = \frac{\eta}{2\epsilon_o} \text{ electric field of infinite plane}$$

$$E = \frac{\eta}{\epsilon_o} \text{ electric field of capacitor}$$

$$E = k \frac{2\lambda}{r} \text{ electric field of infinite line of charge}$$

a distance r from the line

$\vec{E} = \int d\vec{E}$ know how to find electric fields for continuous charge distributions.

λ, η, ρ linear, surface and volume charge density

$\vec{F}_E = q\vec{E}$ force on charge q in electric field \vec{E}