

Linear Motion

$$v = \frac{\Delta d}{\Delta t}$$

$$a = \frac{\Delta v}{\Delta t}$$

$$d = v_1 t + \frac{1}{2} a t^2$$

$$v_2^2 = v_1^2 + 2 a d$$

$$v_2 = v_1 + a t$$

Newtons Laws of Motion

$$F = m a \quad g = 9.80 \text{ m/s}^2$$

$$W = m g \quad f = \mu N = \mu m g$$

Circular Motion

$$T = \frac{1}{f}$$

$$f = \frac{1}{T}$$

$$V = \frac{2\pi r}{T} = 2\pi r f$$

$$a_c = \frac{v^2}{r} = \frac{4\pi^2 r}{T^2} = 4\pi^2 r f^2$$

$$F_c = m a_c = m \frac{v^2}{r} = m \frac{4\pi^2 r}{T^2} = m 4\pi^2 r f^2$$

$$f_{\text{friction}} = \mu N = \mu m g$$

$$v_{\text{max}} = \sqrt{\mu g r}$$

$$\omega = \frac{\Delta \theta}{\Delta t}$$

$$\omega = \omega + \alpha t$$

$$\alpha = \frac{\Delta \omega}{\Delta t}$$

$$\theta = \theta_0 + \omega_0 t + \frac{1}{2} \alpha t^2$$

$$v = r \omega$$

$$\omega^2 = \omega_0^2 + 2\alpha(\theta - \theta_0)$$

$$a_{\text{tan}} = r \alpha$$

$$\theta - \theta_0 = \frac{1}{2}(\omega + \omega_0)t$$

$$a_c = r \omega^2$$

Universal Gravitation

$$F = G \frac{m_1 m_2}{d^2}$$

$$\left(\frac{T_a}{T_b}\right)^2 = \left(\frac{r_a}{r_b}\right)^3$$

$$K = r^3/T^2 = 3.35 \times 10^{18} \text{ m}^3/\text{s}^2$$

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

Momentum

$$\Delta p = m \Delta v$$

$$F \Delta t = m \Delta v$$

Trig Functions

$$\sin \theta = \frac{\text{opp}}{\text{hyp}}$$

$$\cos \theta = \frac{\text{adj}}{\text{hyp}}$$

$$\tan \theta = \frac{\text{opp}}{\text{adj}}$$

Quadratic Formula

$$a x^2 + b x + c = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Energy

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

$$U = GPE = m g h$$

Work and Power

$$W = F d$$

$$P = \frac{W}{t}$$

$$W_i = F_e d_e$$

$$W_o = F_r d_r$$

$$MA = \frac{F_r}{F_e}$$

$$IMA = \frac{d_e}{d_r}$$

$$Eff = \frac{MA}{IMA} \times 100\% = \frac{W_o}{W_i} \times 100\%$$

Electricity

Statics:

$$F = \frac{k q q'}{d^2}$$

$$E = \frac{F}{q}$$

$$V = E d$$

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

$$\Delta V = \frac{\Delta PE}{q} = \frac{U}{q} = \frac{W}{q}$$

Constants:

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

$$k = 9 \times 10^9 \text{ Nm}^2/\text{C}^2$$

Magnetism

$$F = q v \beta \sin \theta$$

$$F = I L \beta \sin \theta$$

$$\phi = \beta A \cos \theta$$

$$E = -\beta L v = N \frac{\Delta \phi}{\Delta t}$$

$$\beta = \mu_0 n I$$

$$\mu_0 = 4\pi \times 10^{-7} \frac{\text{Tm}}{\text{A}}$$

Currents:

$$I = \frac{q}{t}$$

$$I = \frac{V}{R}, R = \frac{V}{I}, V = IR$$

$$P = VI = I^2 R = \frac{V^2}{R}$$

$$E = Pt = I^2 R t$$

$$R_s = R_1 + R_2 + \dots$$

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$$

Light

$$E = \frac{P}{4\pi d^2}$$

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

$$n_i \sin \theta_i = n_r \sin \theta_r$$

$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$

$$d_i = \frac{d_o f}{d_o - f}$$

$$m = \frac{h_i}{h_o} = -\frac{d_i}{d_o}$$