$$\vec{v} = \frac{d\vec{x}}{dt} \qquad \omega = \frac{d\theta}{dt} \qquad \omega_{av} = \frac{\Delta\theta}{\Delta t} \qquad s = r\theta \qquad v = v_0 + at \qquad \omega = \omega_0 + \alpha t$$

$$v = r\omega \qquad x = x_0 + v_0 t + \frac{1}{2}at^2 \qquad \theta = \theta_0 + \omega_0 t + \frac{1}{2}\alpha t^2$$

$$\vec{a} = \frac{d\vec{v}}{dt} \qquad \alpha = \frac{d\omega}{dt} = \frac{d^2\theta}{dt^2} \qquad \alpha_{av} = \frac{\Delta\omega}{\Delta t} \qquad a_{\tan} = r\alpha$$

$$x = x_0 + \frac{1}{2}(v_0 + v)t \qquad \theta = \theta_0 + \frac{1}{2}(\omega_0 + \omega)t$$

$$\Delta\theta = \theta - \theta_0 \qquad \Delta\omega = \omega - \omega_0 \qquad a_{rad} = \frac{v^2}{r} = \omega^2 r \qquad v^2 = v_0{}^2 + 2a(x - x_0) \qquad \omega^2 = \omega_0{}^2 + 2\alpha(\theta - \theta_0)$$

$$\vec{F}_{net} = m\vec{a} \qquad \vec{\tau}_{net} = I\,\vec{\alpha} \qquad I = \sum_i m_i r_i^2 \qquad I = \int r^2 dm \qquad I_P = I_{cm} + Md^2$$

$$\vec{\tau} = \vec{r} \times \vec{F} \qquad \tau = rF\sin\phi = rF_\perp = r_\perp F \qquad P = \tau\,\omega \qquad a_{cm} = r\alpha \qquad v_{cm} = r\omega$$

$$K = \frac{1}{2}I\omega^2 \qquad W_{total} = K_{final} - K_{initial} \qquad K_{final} + U_{final} = K_{initial} + U_{initial} + W_{nonconserative} \qquad W = \int_{\theta_i}^{\theta_f} \tau\, d\theta$$

$$\vec{\tau}_{net} = \frac{d\vec{L}}{dt} \qquad \vec{L} = \sum \vec{\ell} \qquad \vec{\ell} = \vec{r} \times \vec{p} = \vec{r} \times m\vec{v} \qquad \ell = rp\sin\phi = rp_\perp = r_\perp p \qquad \vec{L} = I\vec{\omega}$$

$$F = -kx \qquad x(t) = A\cos(\omega t + \phi) \qquad \omega = \frac{2\pi}{T} = 2\pi f \qquad T = 2\pi\sqrt{\frac{m}{k}} \qquad T = 2\pi\sqrt{\frac{I}{mgd}}$$

$$U = \tfrac{1}{2}kx^2 \qquad a(t) = -\omega^2 x(t)$$

$$\frac{F_\perp}{A} = Y\left(\frac{\Delta\ell}{\ell_0}\right) \qquad \frac{F_\parallel}{A} = S\left(\frac{x}{h}\right) \qquad B = \frac{-\Delta p}{\Delta V / V_0} \qquad v = \sqrt{\frac{B}{\rho}} \qquad v = \sqrt{\frac{Y}{\rho}} \qquad v = \sqrt{\frac{F}{\mu}}$$

$$y(x,t) = funct(x \pm vt) \qquad y(x,t) = A\cos(kx \pm \omega t + \phi) \qquad k = \frac{2\pi}{\lambda} \qquad v = \lambda f = \frac{\omega}{k} \qquad f_L = \left(\frac{v \pm v_L}{v \pm v_S}\right) f_S$$

$$y(x,t) = 2A\cos\left(\frac{\phi}{2}\right)\sin\left(kx - \omega t - \frac{\phi}{2}\right) \qquad y(x,t) = \left[2A\sin(kx)\right]\sin(\omega t) \qquad P_{av} = \tfrac{1}{2}\sqrt{\mu F}\omega^2 A^2$$

$$f_n = nf_1;\ \lambda_n = \frac{2L}{n};\ n = 1, 2, 3, \ldots \qquad p(x,t) = BkA\cos(kx - \omega t) \qquad f_{beat} = \left|f_a - f_b\right|$$

$$I = \frac{P}{A} = \frac{P}{4\pi r^2} \qquad I = \tfrac{1}{2}\sqrt{\rho B}\omega^2 A^2 \qquad \beta = (10\,\text{dB})\log\left(\frac{I}{I_o}\right) \qquad I_o = 10^{-12}\ W/m^2$$

$$n = \frac{c}{v} \qquad n_a\sin\theta_a = n_b\sin\theta_b \qquad \frac{1}{f} = \frac{1}{s} + \frac{1}{s'} \qquad m = \frac{y'}{y} = -\frac{s'}{s} \qquad I = I_{\max}\cos^2\phi \qquad \tan\theta_P = \frac{n_b}{n_a}$$

$$d\sin\theta = m\lambda \quad m = 0, \pm1, \pm2, \ldots \text{ (constructive)} \qquad I = I_0\cos^2\frac{\phi}{2}\left(\frac{\sin(\beta/2)}{\beta/2}\right)^2 \qquad \phi = \frac{2\pi d}{\lambda}\sin\theta$$

$$a\sin\theta = m\lambda \quad m = \pm1, \pm2, \pm3, \ldots \text{ (destructive)} \qquad I = I_0\left(\frac{\sin(\beta/2)}{\beta/2}\right)^2 \qquad \beta = \frac{2\pi}{\lambda}a\sin\theta$$