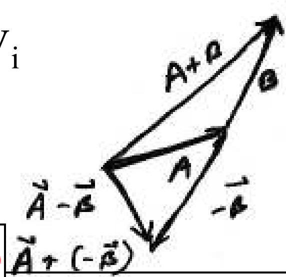
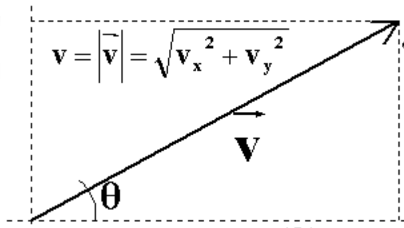
$$\Delta x = x_f - x_i \qquad \Delta v = v_f - v_i$$

$$\vec{v} = \frac{\Delta \vec{r}}{\Delta t} \qquad \vec{a} = \frac{\Delta \vec{v}}{\Delta t}$$





$$v = |\vec{v}| = \sqrt{v_x^{\,2} + v_y^{\,2}}$$

$$v_y = v \sin(\theta) \qquad v_x = v\cos(\theta)$$

$$\theta = \tan^{-1}\left(\frac{v_y}{v_x}\right) \qquad \theta = \cos^{-1}\left(\frac{v_x}{v}\right) \qquad \theta = \sin^{-1}\left(\frac{v_y}{v}\right)$$

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

$$\omega = 2\pi f \qquad f = \frac{1}{T}$$

1D

$$v = v_o + at$$
$$x = x_o + v_o t + \frac{1}{2}at^2$$
$$v^2 - v_o^{\,2} = 2a(x - x_o)$$
$$\bar{v} = \frac{v_f + v_i}{2} \qquad \Delta x = \bar{v}\,\Delta t$$

2D

$$x \rightarrow x, y \qquad x_o \rightarrow x_o, y_o$$
$$v \rightarrow v_x, v_y \qquad v_o \rightarrow v_{ox}, v_{oy}$$
$$a \rightarrow a_x, a_y$$

$$x = r\theta$$
$$v = \omega r$$
$$a = \alpha r$$

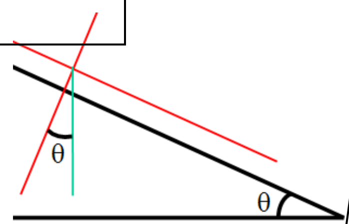
$$\omega = \omega_o + \alpha t$$
$$\theta = \theta_o + \omega_o t + \frac{1}{2}\alpha t^2$$
$$\omega^2 - \omega_o^2 = 2\alpha(\theta - \theta_o)$$

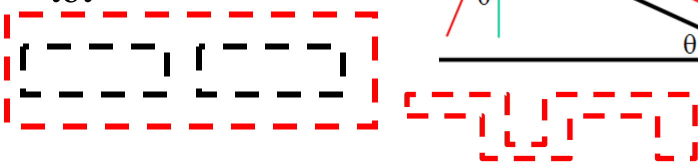
$$I = \sum_i^{all} m_i r_i^2$$

$$\tau = r_\perp F = rF_\perp$$

$$K = \frac{1}{2} I\omega^2 \qquad \tau = I\alpha$$

$$\vec{F}_{tot} = m\,\vec{a}$$





$$\tau = 0 \Rightarrow \Delta L = 0$$

$$L = r_\perp p = mvr_\perp \qquad \tau = \frac{\Delta L}{\Delta t}$$

$$L = I\omega$$

$$W = F\,d_{\parallel} = F_{\parallel}\,d \qquad a = \frac{v^2}{R} \qquad \mu N$$

$$W_{tot} = \Delta(KE) \qquad KE = \frac{1}{2}mv^2 \qquad \Delta U = -W_{if}$$

$$\vec{p} = m\,\vec{v}$$

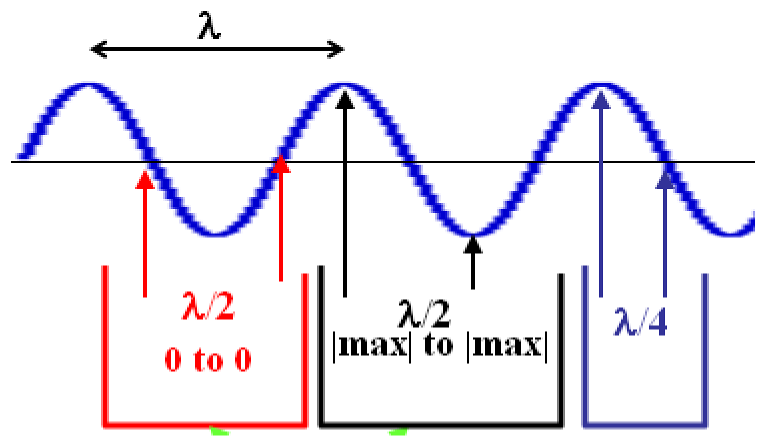
$$\vec{P}_{init} = \vec{P}_{final} \qquad \left(\sum_j^{all} m_j \vec{v}_j\right)_{init} = \left(\sum_j^{all} m_j \vec{v}_j\right)_{final}$$

$$\rho = m / V$$
$$P = F / A$$
$$\Delta P = \rho g h$$
$$B = \rho_{liq} V_{disp}\, g$$
$$Av = \text{const.}$$
$$P + \frac{1}{2}\rho v^2 = \text{const.}$$

$$\sum_i^{all} \vec{F}_i = 0$$

$$\sum_i^{all} \vec{\tau}_i = 0$$

$$x = A\sin(\omega t + \delta)$$
$$v = A\omega \cos(\omega t + \delta)$$
$$a = -A\omega^2 \sin(\omega t + \delta)$$
$$\omega = \sqrt{k/m}$$



$$v = \lambda f$$
$$v = \sqrt{\frac{T}{\mu}}$$

$$\frac{GMm}{r^2}$$
$$-\frac{GMm}{r}$$
$$\frac{GM_e}{R_e} = gR_e$$
$$M_e = 5.97(10)^{24}\ \text{kg}$$
$$R_e = 6.37(10)^{6}\ \text{m}$$
$$G = 6.67(10)^{-11}\ \text{Nm}^2/\text{kg}^2$$

$$\Delta Q = \ell\ \Delta(\text{quant.})$$
$$\Delta Q_{into} = \Delta W_{by} + \Delta U$$
$$\Delta Q = (\text{quant.})C_{cond}\ \Delta T$$

For IG
$$\begin{cases} \Delta W_{by} = P\Delta V \\ \Delta U\ \alpha\ \Delta T \\ C_P = C_V + R \end{cases}$$
$$R = 8.31\ \text{J}/(\text{mole K})$$

$$\frac{RT}{2}\Big|_{deg.\ freedom}$$

$$e = \frac{\Delta W}{Q_H}$$
$$e = 1 - \frac{T_L}{T_H}$$
$$\Delta S \geq 0$$