$v_{av} = \frac{\Delta x}{\Delta t}$ $v = \lim_{\Delta t \to 0} \frac{\Delta x}{\Delta t} = \frac{dx}{dt}$ $a_{av} = \frac{\Delta v}{\Delta t}$ $a = \frac{dv}{dt} = \frac{d^2x}{dt^2}$

$v = v_0 + at$ $\Delta x = x - x_0 = v_0 t + \frac{1}{2} at^2$ $v^2 = v_0^2 + 2a\ \Delta x$ $a_c = \frac{v^2}{r}$

$\vec{v} = \lim_{\Delta t \to 0} \frac{\Delta \vec{r}}{\Delta t} = \frac{d\vec{r}}{dt}$ $\vec{a} = \lim_{\Delta t \to 0} \frac{\Delta \vec{v}}{\Delta t} = \frac{d\vec{v}}{dt}$ $R = \frac{v_0^2}{g} \sin 2\theta$ $\vec{F}_{net} = m\vec{a}$

$\vec{w} = m\vec{g}$ $f_s \leq \mu_s F_n$ $f_k = \mu_k F_n$ $F_x = -\frac{dU}{dx}$ $F_x = -k\Delta x$

$W = F\cos\theta \Delta x = F_x \Delta x$ $W = \int_{x_1}^{x_2} F_x dx$ $W = \int_{s_1}^{s_2} \vec{F} \cdot d\vec{s}$ $K = \frac{1}{2} mv^2$

$\vec{A} \cdot \vec{B} = AB \cos \phi$ $\vec{A} \cdot \vec{B} = A_x B_x + A_y B_y + A_z B_z$ $U = mgy$ $W = \Delta K$

$U = \frac{1}{2} kx^2$ $K = \frac{p^2}{2m}$ $W_{nc} = \Delta(U + K) = \Delta E$ $P = \frac{dW}{dt} = \vec{F} \cdot \vec{v}$

$M\vec{R}_{cm} = \sum_i M_i \vec{\mathbf{r}}_i$ $\vec{F}_{net,ext} = M\vec{A}_{cm}$ $\vec{p} = m\vec{v}$ $\vec{F}_{net} = \frac{d\vec{p}}{dt}$

$\vec{P} = \sum_i m_i \vec{v}_i = M\vec{V}_{cm}$ $\vec{I} = \int_{t_i}^{t_f} \vec{F} dt = \Delta \vec{P}$ $\vec{F}_{av} = \frac{1}{\Delta t} \int_{t_i}^{t_f} \vec{F} dt = \frac{\vec{I}}{\Delta t}$

$m \frac{dv}{dt} = u_{ex} \left| \frac{dm}{dt} \right| + \vec{F}_{ext}$ $\omega = \frac{d\theta}{dt}$ $\alpha = \frac{d\theta}{dt} = \frac{d^2\theta}{dt^2}$ $v = r\omega$

$a_t = r\alpha$ $a_c = \frac{v^2}{r} = r\omega^2$ $\omega = \omega_0 + \alpha t$ $\theta = \theta_0 + \omega_0 t + \frac{1}{2} \alpha t^2$

$\omega^2 = \omega_0^2 + 2\alpha(\theta - \theta_0)$ $\tau_{net} = I\alpha$ $I = \sum m_i r_i^2$ $K = \frac{1}{2} I\omega^2$

$P = \tau\omega$ $L = I\omega$ $\vec{A} \times \vec{B} = (AB \sin \phi)\hat{n}$ $\vec{\tau} = \vec{r} \times \vec{F}$ $\vec{L} = \vec{r} \times \vec{p}$

$\rho = M/V$ $g = 9.81 \frac{m}{s^2}$

Moments of Inertia

Thin spherical shell about diameter: $I = \frac{2}{3} M R^2$

Solid sphere about diameter: $I = \frac{2}{5} M R^2$

Solid cylinder about axis: $I = \frac{1}{2} M R^2$

Cylindrical shell about axis: $I = M R^2$

Thin rod about perpendicular line through center: $I = \frac{1}{12} M L^2$

Thin rod about perpendicular line through end: $I = \frac{1}{3} M L^2$