

PHYS101 Formula Sheet for the Second Major Exam

$\vec{r} - \vec{r}_o = \vec{v}_o t + \frac{1}{2} \vec{a} t^2$ $\vec{v} = \vec{v}_o + \vec{a} t$ $v^2 = v_o^2 + 2a(x - x_o)$ $x - x_o = \frac{1}{2}(v + v_o)t$	<p><i>If α is constant :</i></p> $\omega = \omega_o + \alpha t$ $\theta - \theta_o = \omega_o t + \frac{1}{2} \alpha t^2$ $\omega^2 = \omega_o^2 + 2\alpha(\theta - \theta_o)$
$\sum \vec{F} = m\vec{a} = \frac{d\vec{p}}{dt}$ $f_k = \mu_k N$ $f_s \leq \mu_s N$ $W = \int \vec{F} \cdot d\vec{r}$ $W = \vec{F} \cdot \vec{d} \text{ if } \vec{F} \text{ is a constant}$	$I = \sum_i m_i r_i^2 = \int r^2 dm$ $I_p = I_{com} + Mh^2$ $\vec{\tau} = \vec{r} \times \vec{F}$ $\tau = rF \sin \theta = r_{\perp} F = rF_{\perp}$ $W = \int \tau d\theta$ <p align="center"><i>= $\tau \Delta\theta$ if τ is constant</i></p>
$\vec{A} \cdot \vec{B} = AB \cos \theta$ $ \vec{A} \times \vec{B} = AB \sin \theta$	$K = \frac{1}{2} I_{com} \omega^2 + \frac{1}{2} Mv_{com}^2$ $\vec{l} = \vec{r} \times \vec{p} = m\vec{r} \times \vec{v}$
$W_{net} = \Delta K = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2$ $P = \frac{dW}{dt} = \vec{F} \cdot \vec{v}$ $U_s = \frac{1}{2} kx^2, \quad F_s = -kx$ $U_g = mgy$ $E_{mech} = K + U$ $\Delta U = -W \text{ for a conservative force}$ $\Delta K + \Delta U + \Delta E_{th} = W$ <p><i>where $\Delta E_{th} = f_k d$</i></p>	$l = m r_{\perp} v = m r v_{\perp}$ <p><u><i>For a solid rotating about a fixed axis :</i></u></p> $K_{rot} = \frac{1}{2} I \omega^2, \quad L_z = I \omega$ $\Delta K = \frac{1}{2} I (\omega_f^2 - \omega_i^2) = W$ $P = \frac{dW}{dt} = \tau \omega$ $\vec{\tau} = \frac{d\vec{l}}{dt}$
$\vec{J} = \int \vec{F} dt = \vec{F}_{avg} \Delta t = \Delta \vec{p}$ $\vec{p}_{1i} + \vec{p}_{2i} = \vec{p}_{1f} + \vec{p}_{2f}$ $\sum \vec{F}_{ext} = M\vec{a}_{cm}$ $\vec{r}_{com} = \frac{1}{M} \sum_{i=1}^n m_i \vec{r}_i = \frac{1}{M} \int \vec{r} dm$ $v_{1f} = \frac{m_1 - m_2}{m_1 + m_2} v_{1i} + \frac{2m_2}{m_1 + m_2} v_{2i}$ $v_{2f} = \frac{2m_1}{m_1 + m_2} v_{1i} + \frac{m_2 - m_1}{m_1 + m_2} v_{2i}$	$\sum \vec{\tau}_{ext} = \frac{d\vec{L}}{dt} = I\vec{\alpha}$ $\int x^n dx = \frac{x^{n+1}}{n+1}$ <p>$g = 9.80 \text{ m/s}^2$</p> $I_{com} (\text{cylinder}) = \frac{1}{2} MR^2$ $I_{com} (\text{solid sphere}) = \frac{2}{5} MR^2$ $I_{com} (\text{thin rod}) = \frac{1}{12} ML^2$ $I_{com} (\text{hoop, about central axis}) = MR^2$ $I_{com} (\text{hoop, about diameter}) = \frac{1}{2} MR^2$
$\omega = \frac{d\theta}{dt}; \quad \alpha = \frac{d\omega}{dt}$ $s = r\theta, \quad v = r\omega$ $a_t = r\alpha; \quad a_r = \frac{v^2}{r} = r\omega^2$ $\vec{a} = \vec{a}_t + \vec{a}_r$	