

$\vec{v} = \frac{d\vec{r}}{dt}$	$\sum \vec{F} = m\vec{a} = \frac{d\vec{p}}{dt}$	$W = \int \vec{F} \cdot d\vec{s}$	$\vec{r}_{\text{cm}} = \frac{\sum \vec{r}_i m_i}{\sum m_i}$
$\vec{\omega} = \frac{d\vec{\theta}}{dt}$	$\sum \vec{F}_{\text{ext}} = M\vec{a}_{\text{cm}} = \frac{d\vec{P}}{dt}$	$W_{\text{ext}} = \Delta K + \Delta U + \Delta E_{\text{th}}$	$\vec{r}_{\text{cm}} = \frac{\int \vec{r} dm}{\int dm}$
$\vec{a} = \frac{d\vec{v}}{dt}$	$\sum \vec{\tau}_{\text{ext}} = I\vec{\alpha} = \frac{d\vec{L}}{dt}$	$K = \frac{1}{2}mv^2$	$I = \sum m_i r_i^2$
$\vec{\alpha} = \frac{d\vec{\omega}}{dt}$	$f_{s,\text{max}} = \mu_s n$	$K = \frac{1}{2}I\omega^2$	$I = \int r^2 dm$
$v_{\text{sf}} = v_{\text{si}} + a_s \Delta t$	$f_k = \mu_k n$	$U_g = mgy$	$I = I_{\text{cm}} + Md^2$
$\omega_f = \omega_i + \alpha \Delta t$	$a_r = \frac{v^2}{r}$	$U_s = \frac{1}{2}k(\Delta s)^2$	$\vec{L} = \vec{r} \times \vec{p}$
$s_f = s_i + v_{\text{si}} \Delta t + \frac{1}{2}a_s (\Delta t)^2$	$\vec{w} = m\vec{g}$	$U_G = -\frac{Gm_1 m_2}{r}$	$\vec{L} = I\vec{\omega}$
$\theta_f = \theta_i + \omega_{\text{si}} \Delta t + \frac{1}{2}\alpha (\Delta t)^2$	$ \vec{F}_G = \frac{Gm_1 m_2}{ \vec{r} ^2}$	$P = \frac{dE_{\text{sys}}}{dt}$	$x = A \cos(\omega t + \phi_0)$
$s = r\theta$	$D = \frac{1}{2}C\rho Av^2$	$P = \vec{F} \cdot \vec{v}$	$\vec{a}_x = -\omega^2 \vec{x}$
$v = r\omega$	$\vec{\tau} = \vec{r} \times \vec{F}$	$\vec{J} = \int \vec{F} dt = \Delta\vec{p}$	$\omega = \sqrt{k/m}$
$a_t = r\alpha$		$\vec{p} = m\vec{v}$	$\omega = 2\pi f = \frac{2\pi}{T}$

Physical Constants:

Universal Gravitation Constant $G = 6.673 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2$
 Gravitational Acceleration at Earth's Surface $g = 9.81 \text{ m/s}^2$

Unless otherwise directed, drag is to be neglected, all problems take place on Earth, use the gravitational definition of weight, and all springs, ropes, and pulleys are ideal.

All derivatives and integrals in free-response problems must be evaluated.

You may remove this sheet from your Quiz or Exam, but it must be submitted