The following equations will be given on the second exam in this form. All of your solutions for the problems should start from these equations.

EQUATIONS

$\mathbf{v}_{av} = \Delta\mathbf{r} / \Delta t$	$\mathbf{v} = d\mathbf{r} / dt$	$\mathbf{a}_{av} = \Delta\mathbf{v} / \Delta t$
$\mathbf{a} = d\mathbf{v} / dt$	$v^2 = v_o^2 + 2a\Delta x$	$\Delta x = v_o t + 1/2 at^2$
$v = v_o + at$	$\Delta x = 1/2(v_o + v)t$	$a = v^2 / R$
$v = 2\pi r / T$	$x = -b \pm \text{sq.rt.}(b^2 - 4ac) / 2a$	
$\mathbf{F}_{\mathbf{NET}} = m\mathbf{a}$	$W = F_g = mg$	$D = 1/2\ C\rho A v^2$
$F = Gm_1 m_2 / r^2$	$\mathbf{F}_1 = \int d\mathbf{F}$	$f_{s,max} = \mu_s F_N$
$f_k = \mu_k F_N$	$K = 1/2\ mv^2$	$W = Fd\cos\phi = \mathbf{F}\cdot\mathbf{d}$
$W = \Delta K$	$F_x = -kx$	$W_s = 1/2 kx_i^2 - 1/2 kx_f^2$
$W = \int_{x1}^{x2} F(x)dx$	$P_{avg} = W / \Delta t$	$P = dW / dt$
$W = \int_{ri}^{rf} F\cos\phi dr = \int_{ri}^{rf} \mathbf{F}\cdot d\mathbf{r}$	$U(y) = mgy$	$U(x) = 1/2 kx^2$
$F(x) = - dU(x) / dx$	$W = \Delta E = \Delta E_{mec} + \Delta E_{th} + \Delta E_{int}$	$\Delta E_{th} = f_k d$
$U = -GMm / r$	$\mathbf{r}_{com} = 1/M\ \Sigma m_i \mathbf{r}_i$	$x_{com} = \int x\ dm$
$\mathbf{p} = m\ \mathbf{v}$	$\mathbf{J} = \Delta\mathbf{p}$	$\mathbf{J} = \int_{ti}^{tf} \mathbf{F}(t)dt$
$\mathbf{J} = \mathbf{F}_{avg}\Delta t$	$s = r\theta$	$\omega_{av} = \Delta\theta / \Delta t$
$\omega = d\theta / dt$	$\alpha_{av} = \Delta\omega / \Delta t$	$\alpha = d\omega / dt$
$\omega = \omega_o + \alpha t$	$\Delta\theta = \omega_o t + 1/2\ \alpha t^2$	$\omega^2 = \omega_o^2 + 2\alpha\Delta\theta$
$\Delta\theta = 1/2(\omega_o + \omega)t$	$v = r\omega$	$a_t = r\alpha$
$I = \Sigma m_i r_i^2$	$K = 1/2\ I\ \omega^2$	$I = \int r^2 dm$
$I = I_{cm} + Mh^2$	$\tau = Fr_\perp = F r\sin\phi$	$\tau_{net} = I\alpha$
$W = \int_{\theta i}^{\theta f} \tau d\theta$	$\boldsymbol{\tau} = \mathbf{r} \times \mathbf{F}$	$\mathbf{l} = \mathbf{r} \times \mathbf{p}$
$\boldsymbol{\tau}_{net} = d\mathbf{l} / dt$	$L = I\omega$	$\Omega = Mgr / I\omega$

CONSTANTS

$g = 9.8\ m/s^2$ $\qquad G = 6.67 \times 10^{-11}\ Nm^2/kg^2$