Linear Kinematics

$v_f = v_i + at$ $\quad \Delta x = \frac{1}{2}(v_i + v_f)t$

$v_f^2 = v_i^2 + 2a\Delta x$ $\quad \Delta x = v_i t + \frac{1}{2}at^2$

Rotational Kinematics

$\omega = \omega_i + \alpha t$ $\quad \theta = \frac{1}{2}(\omega_f - \omega_i)t$

$\omega^2 = \omega_i^2 + 2\alpha\theta$ $\quad \theta = \omega_i t + \frac{1}{2}\alpha t^2$

Projectile Motion

$v_x = v\cos\theta$ $\quad$ max height $h = \frac{v_y^2}{2g}$

$v_y = v\sin\theta$ $\quad$ max range $r = \frac{v_x^2 \sin(2\theta)}{g}$

$\theta = \tan^{-1}\frac{v_y}{v_x}$ $\quad$ distance $d = \frac{1}{2}a_x t^2$

$t = \frac{2v_y}{g}$

Force

Newton's Second Law $\quad F = ma$

Hooke's Law $\quad F_{spring} = -kx$

$F_{normal} = mgcos\theta$ $\quad F_{friction} = \mu_k F_N$

$F_{centripetal} = \frac{mv^2}{r} = m\omega^2$

Momentum

$p_i = p_f$ $\quad L_i = L_f$

$p = mv$ $\quad L = I\omega$

$L = r \times p = mv\sin\theta$

Torque

$\tau = \Delta L$

$\tau = rFsin\phi$

$\tau = I\alpha$

Parallel Axis Theorem

$I_p = I_c + md^2$

Potential Energy

$U_{gravity} = mgh$ $\quad U_{spring} = \frac{1}{2}kx^2$

Kinetic Energy

$K = \frac{1}{2}mv^2$ $\quad K_{rotational} = \frac{1}{2}I\omega^2$

$K_{rolling} = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$

Circular Motion

$f = \frac{rev}{sec}$ $\quad 1\frac{rev}{sec} = 2\pi\frac{rad}{sec}$

$F = m\frac{v^2}{r}$ $\quad F = m\omega^2 r$

$\omega = 2\pi f$ $\quad \alpha = \frac{v^2}{r}$

$\omega = \frac{v}{r}$ $\quad \alpha = \frac{a}{r}$

Work and Power

$E_i = PE_i + KE_i$ $\quad E_f = PE_f + KE_f$

$W = \Delta E = E_f - E_i$ $\quad P = \frac{W}{t}$

$W_{linear} = FDcos\theta$ $\quad W_{rotational} = \tau\theta$

$P_{linear} = Fv$ $\quad P_{rotational} = \tau\omega$

Impulse

Δp $\quad \Delta L$

$F\Delta t = m\Delta v$ $\quad \tau\Delta t = m\Delta\omega$

Moments of Inertia

point mass	$I = MR^2$
solid disk	$I = \frac{1}{2}MR^2$
solid sphere	$I = \frac{2}{5}MR^2$
hollow sphere	$I = \frac{2}{3}MR^2$
rod (center)	$I = \frac{1}{3}MR^2$
rod (end)	$I = \frac{1}{12}MR^2$