Equations for Exam 3

Momentum, Impulse, and Center of Mass

$\vec{\boldsymbol{p}} = m\vec{\boldsymbol{v}}$ $\quad \vec{\boldsymbol{F}} = \frac{d\vec{\boldsymbol{p}}}{dt}$ $\quad \vec{\boldsymbol{F}}_{\text{avg}}\Delta t = \Delta\vec{\boldsymbol{p}}$

$\vec{\boldsymbol{x}}_{\text{cm}} = \frac{1}{m}\sum m_i\vec{\boldsymbol{x}}_i$ $\quad \vec{\boldsymbol{p}} = m\vec{\boldsymbol{v}}_{\text{cm}}$ $\quad \vec{\boldsymbol{F}} = m\vec{\boldsymbol{a}}_{\text{cm}}$

Special case: $K_i = K_f,$ $\quad v_2^i - v_1^i = v_1^f - v_2^f$

Rigid Body Motion, Rotations

$x \to \theta,$ $\quad v \to \omega,$ $\quad a \to \alpha,$ $\quad m \to I,$ $\quad \vec{\boldsymbol{F}} \to \vec{\boldsymbol{\tau}},$ $\quad \vec{\boldsymbol{p}} \to \vec{\boldsymbol{L}}$

$\omega = \frac{d\theta}{dt},$ $\quad \alpha = \frac{d\omega}{dt}$ $\quad$ Special cases: $v = r\omega,$ $a = r\alpha$

$I = \sum m_i r_i^2$ $\quad K_{\text{rot}} = \frac{1}{2}I\omega^2$ $\quad K = K_{\text{cm}} + K_{\text{rot}}$ $\quad L = I\omega$

$\tau = rF\sin\theta$ $\quad \tau = I\alpha$ $\quad \vec{\boldsymbol{\tau}} = \vec{\boldsymbol{r}} \times \vec{\boldsymbol{F}}$ $\quad \vec{\boldsymbol{L}} = \vec{\boldsymbol{r}} \times \vec{\boldsymbol{p}}$ $\quad \vec{\boldsymbol{\tau}} = \frac{d\vec{\boldsymbol{L}}}{dt}$

Earlier Equations

$v = \frac{dx}{dt}$ $\quad a = \frac{dv}{dt}$ $\quad$ Special case: $a = \frac{v^2}{R}$

Special case: $v = v_0 + at$ $\quad x = x_0 + v_0 t + \frac{1}{2}at^2$ $\quad v^2 = v_0^2 + 2a(x - x_0)$

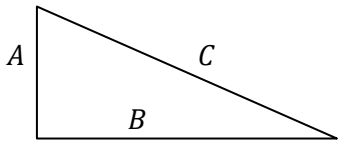
$\vec{\boldsymbol{F}} = m\vec{\boldsymbol{a}}$ $\quad \vec{\boldsymbol{F}}_{12} = -\vec{\boldsymbol{F}}_{21}$ $\quad F_g = mg$ $\quad g = 9.8\ \text{m/s}^2$

$F_f = \mu_k F_N,$ $\quad F_f \le \mu_s F_N$

$\text{W} = \int \vec{\text{F}} \cdot \text{d}\vec{\text{s}}$ $\quad$ or $\quad W = \vec{F} \cdot \Delta\vec{s}$ $\quad$ or $\quad W = \int F dx$ $\quad$ or $\quad W = F\Delta x$

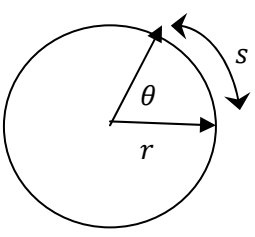
$K = \frac{1}{2}mv^2$ $\quad \Delta K = W$ $\quad \Delta U = -W$ $\quad E = K + U$ $\quad U_g = mgh$

Mathematics



$\sin\theta = \frac{A}{C}$ $\quad \cos\theta = \frac{B}{C}$ $\quad \tan\theta = \frac{A}{B}$ $\quad C^2 = A^2 + B^2$

$s = r\theta$



$\vec{\boldsymbol{C}} = \vec{\boldsymbol{A}} \times \vec{\boldsymbol{B}}$

$C = AB\sin\theta$

$\vec{\boldsymbol{C}} \perp \vec{\boldsymbol{A}},$ $\quad \vec{\boldsymbol{C}} \perp \vec{\boldsymbol{B}}$