

# Equations for Exam 3

## Momentum, Impulse, and Center of Mass

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

$$\vec{x}_{\text{cm}} = \frac{1}{m} \int \vec{x} dm \qquad \vec{p} = m\vec{v}_{\text{cm}} \qquad \vec{F} = m\vec{a}_{\text{cm}}$$

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

## Rigid Body Motion, Rotations

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

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

$$I = \int r^2 dm \qquad K_{\text{rot}} = \frac{1}{2} I \omega^2 \qquad K = K_{\text{cm}} + K_{\text{rot}} \qquad L = I\omega$$

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

## Earlier Equations

$$v = \frac{dx}{dt} \qquad a = \frac{dv}{dt}$$

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

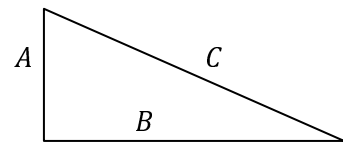
$$\vec{F} = m\vec{a} \qquad \vec{F}_{12} = -\vec{F}_{21} \qquad F_g = mg \qquad g = 9.8 \text{ m/s}^2$$

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

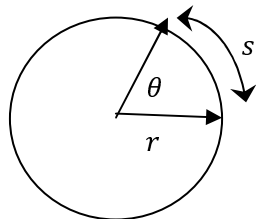
$$K = \frac{1}{2} mv^2 \qquad \Delta K = W \qquad \Delta U = -W \qquad E = K + U \qquad U_g = mgh$$

## Mathematics

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



$$s = r\theta$$



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

$$C = AB \sin \theta$$

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

