

## Physics 195 Equation Sheet:

### Quiz #1:

$$v_f = v_o + at \quad x_f = x_o + v_o t + \frac{1}{2} at^2 \quad v_f^2 = v_o^2 + 2a \Delta x \quad (\text{for motion in one-dimension, constant acceleration})$$

$$v = dx/dt \quad a = dv/dt$$


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### Quiz #2:

$$a_c = v^2/R \quad \sum \vec{F}_{\text{ext}} = m \vec{a} \quad \text{you can't push on a rope}$$

$$f_s \leq \mu_s n, \quad a_t = \frac{d|\vec{v}|}{dt} \quad f_k = \mu_k n \quad W = \int \vec{F} \cdot d\vec{x} \quad K = \frac{1}{2} mv^2$$

$$U(y) = mgy + U_0 \quad \text{Conservative forces: } \{ W_{\text{net}} = \Delta K, \quad W_{\text{net}} = -\Delta U \}$$

$$P = dW/dt \quad F_s = -kx \quad U_s = \frac{1}{2} kx^2 \quad \Delta K_{\text{NC}} = -f_k d$$


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### Quiz #3:

$$E_f = E_o - E_{\text{lost}} + W_{\text{other}} \quad E = K + U \quad \sum \vec{F}_{\text{ext}} = \frac{d\vec{p}}{dt} \quad \vec{I} = \Delta \vec{p} = \int \vec{F}(t) dt \quad \sum \vec{F} = M \vec{a}_{\text{cm}}$$

$$\vec{p} = m\vec{v} \quad \vec{r}_{\text{cm}} = \frac{\int \vec{r} dm}{\int dm}$$


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### Quiz #4:

$$\vec{\omega} = \frac{d\vec{\theta}}{dt} \quad \vec{\alpha} = \frac{d\vec{\omega}}{dt} \quad v_t = r\omega \quad a_t = r\alpha \quad \tau = r F \sin(\vec{r}, \vec{F}) = Fr_{\perp} \quad I = \sum m_i r_i^2$$

$$I = \int r^2 dm \quad \sum \vec{\tau} = I \vec{\alpha} \quad \sum \vec{F} = M \vec{a}_{\text{cm}} \quad K_{\text{rot}} = \frac{1}{2} I \omega^2 \quad \vec{r}_{\text{cm}} = \frac{\int \vec{r} dm}{\int dm} \quad x_{\text{cm}} = \frac{\sum m_i x_i}{\sum m_i}$$

$$\text{Rolling: } v_{\text{cm}} = r\omega \quad \& \quad a_{\text{cm}} = r\alpha \quad I_{\text{PA}} = I_{\text{cm}} + Mh^2$$

$$\vec{L} = \vec{r} \times \vec{p} \quad \vec{L} = I \vec{\omega} \quad \sum \vec{\tau}_{\text{ext}} = \frac{d\vec{L}}{dt} \quad \vec{\tau} = \vec{r} \times \vec{F}$$


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$$\text{Final Exam: } \omega = \sqrt{\frac{k}{m}} \quad \omega = \frac{2\pi}{T} \quad f = \frac{1}{T} \quad T = 2\pi \sqrt{\frac{L}{g}} \quad T = 2\pi \sqrt{\frac{I}{MgD}}$$

$$\text{if } \frac{d^2 x}{dt^2} = -\omega^2 x, \text{ then } x(t) = x_m \cos(\omega t + \phi)$$