$$\vec{\tau} \quad = \quad \vec{r} \times \vec{F}_g \; + \; \vec{r} \times \vec{T}$$

$$\vec{\tau} \quad = \quad |L| \, |mg| \, \sin(\theta) \quad \text{into page}$$

$$\vec{\tau} \quad \simeq \quad |L| \, |mg| \, \theta \quad \text{into page}$$

$$\tau \quad = \quad -Lmg \; \theta$$

$$I \quad = \quad mL^2$$

$$mL^2 \, \alpha \quad = \quad -Lmg \; \theta$$

$$\alpha \quad = \quad -\left(\frac{g}{L}\right) \; \theta$$

$$\frac{d^2\theta}{dt^2} \quad = \quad -\left(\frac{g}{L}\right) \; \theta$$

$$\omega \quad = \quad \sqrt{\frac{g}{L}}$$

$$\frac{d^2\theta}{dt^2} \quad = \quad -\omega^2 \; \theta$$

$$\theta(t) \quad = \quad A \cos(\omega t \; + \; \phi)$$

$$P \quad = \quad \frac{2\pi}{\omega} \quad = \quad 2\pi \sqrt{\frac{L}{g}}$$

$$g \quad = \quad \frac{4\pi^2 L}{P^2}$$

$$P^2 \quad = \quad \left(\frac{4\pi^2}{g}\right) \, L$$

$$\vec{\tau} \quad = \quad \vec{R} \times \vec{F}_g \; + \; \vec{0} \times \vec{T}$$

$$\vec{\tau} \quad = \quad |R| \, |mg| \, \sin(\theta) \quad \text{into page}$$

$$\vec{\tau} \quad \simeq \quad |R| \, |mg| \, \theta \quad \text{into page}$$

$$\tau \quad = \quad -Rmg\ \theta$$

$$I\,\alpha \quad = \quad -Rmg\ \theta$$

$$I \quad = \quad I_{\text{Center of Mass}} \ + \ mR^2$$

$$I \quad = \quad \frac{1}{2}\,mR^2 \ + \ mR^2 \quad = \quad \frac{3}{2}\,mR^2$$

$$\frac{3}{2}\,mR^2\,\alpha \quad = \quad -Rmg\ \theta$$

$$\alpha \quad = \quad -\left(\frac{mgR}{I}\right)\ \theta$$

$$\frac{d^2\theta}{dt^2} \quad = \quad -\left(\frac{mgR}{I}\right)\ \theta$$

$$\omega \quad = \quad \sqrt{\frac{mgR}{I}}$$

$$\frac{d^2\theta}{dt^2} \quad = \quad -\omega^2\ \theta$$

$$\theta(t) \quad = \quad A\cos(\omega t \ + \ \phi)$$

$$P \quad = \quad \frac{2\pi}{\omega} \quad = \quad 2\pi\sqrt{\frac{L}{g}}$$

$$g \quad = \quad \frac{4\pi^2 L}{P^2}$$

$$P^2 \quad = \quad \left(\frac{4\pi^2}{g}\right)\ L$$