

$$F = -T\hat{\rho} - mgy\hat{j} \quad // \quad \hat{j} = -\cos\theta\hat{\rho} + \sin\theta\hat{\sigma}$$

$$F = -T\hat{\rho} - mgy(-\cos\theta\hat{\rho} + \sin\theta\hat{\sigma})$$

$$F = (\cos\theta mgy - T)\hat{\rho} - mgy\sin\theta\hat{\sigma}$$

o.o

$$(\cos\theta mgy - T)\hat{\rho} - mgy\sin\theta\hat{\sigma} = m a_0 \hat{x} + m[(-\rho\dot{\theta}^2)\hat{\rho} + \rho\ddot{\theta}\hat{\sigma}]$$

$$(\cos\theta mgy - T)\hat{\rho} - mgy\sin\theta\hat{\sigma} = m a_0(-\sin\theta\hat{\rho} - \cos\theta\hat{\sigma}) + m L \ddot{\theta}\hat{\sigma}$$

$$\Rightarrow \cos\theta mgy - T - m a_0 \sin\theta = m L \ddot{\theta}$$

$$\Rightarrow -mgy\sin\theta = -T a_0 \cos\theta + m L \ddot{\theta}$$

$$\text{de } \ddot{\theta} \Rightarrow -g\sin\theta + a_0\cos\theta = L \ddot{\theta}$$

$$-\frac{g}{L}\sin\theta + \frac{a_0}{L}\cos\theta = \frac{d\ddot{\theta}}{d\theta}\dot{\theta}$$

$$\int \left( -\frac{g}{L}\sin\theta d\theta + \int \frac{a_0}{L}\cos\theta d\theta \right) = \int d\dot{\theta}\dot{\theta}$$

$$\frac{g}{L}\cos\theta \Big|_0^\theta + \frac{a_0}{L}\sin\theta \Big|_0^\theta = \frac{\dot{\theta}^2}{2}$$

$$\frac{g}{L}(\cos\theta - 1) + \frac{a_0}{L}\sin\theta = \frac{\dot{\theta}^2}{2}$$

$$\Rightarrow \text{max. } \dot{\theta} \Rightarrow \dot{\theta} = 0$$

$$g\cos\theta + a_0\sin\theta = g \Rightarrow g\sqrt{1-\sin^2\theta} + a_0\sin\theta = g$$