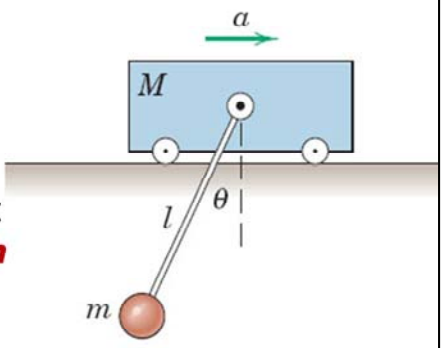
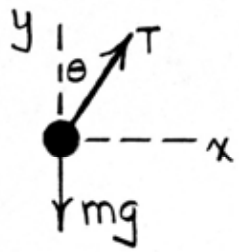
Rectilinear Motion: Exercise 4

A bar of ***length*** l and negligible ***mass*** connects the cart of ***mass*** M and the particle of ***mass*** m. The cart has a constant ***acceleration*** a to the right.



What is the resulting steady-state ***angle*** θ which the freely pivoting bar makes with the vertical?

3/35 Mass m :



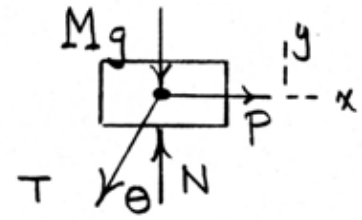
$\Sigma F_y = 0$: $T\cos\theta - mg = 0$

$T = mg/\cos\theta$

$\Sigma F_x = ma_x$: $T\sin\theta = ma$

$\left(\frac{mg}{\cos\theta}\right)\sin\theta = ma$, $\underline{\theta = \tan^{-1}\left(\frac{a}{g}\right)}$

Cart M :



$\Sigma F_x = ma_x$: $P - T\sin\theta = Ma$

$P = ma + Ma = \underline{(m+M)a}$