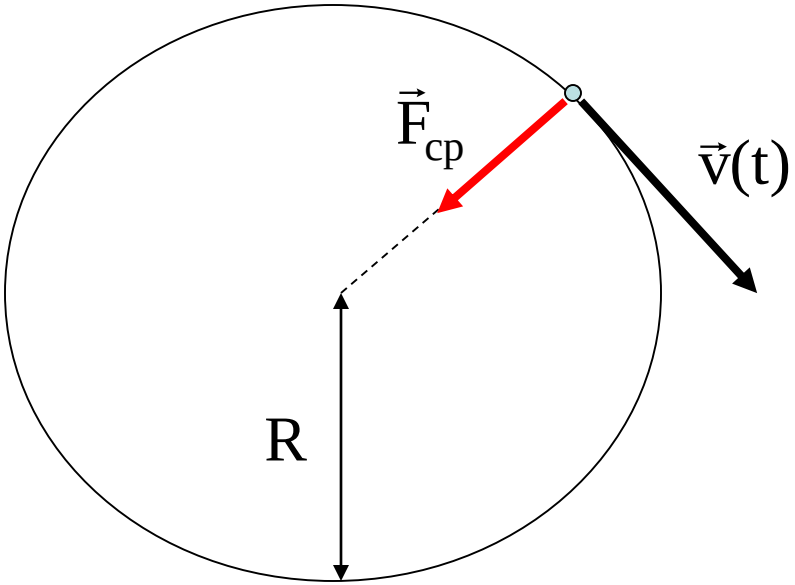
Circular motion

2. Circular motion and accelerated frames

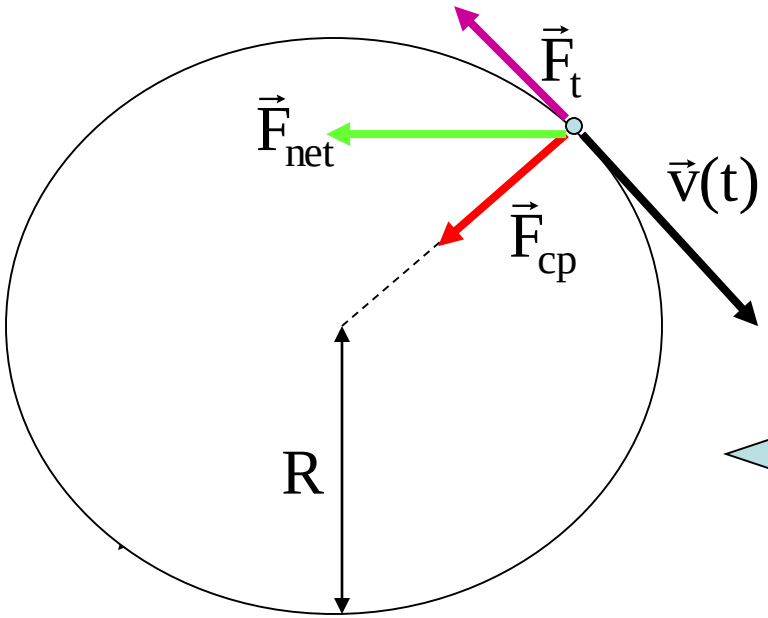


Centripetal force: $\vec{F}_{cp} = m\vec{a}_{cp}$

$$F_{cp} = ma_{cp} = m\frac{v^2}{R}$$

$\Leftarrow$ v=const. $\vec{F}_{cp}, \vec{a}_{cp} \perp \vec{v}(t)$

Circular motion: $\vec{F}_{cp} = \vec{F}_{net}$



$\vec{a} = \vec{a}_{cp} + \vec{a}_t$ $\qquad$ $\vec{F}_{net} = m\vec{a}_{cp} + m\vec{a}_t$

$$a_t = \frac{dv}{dt}$$

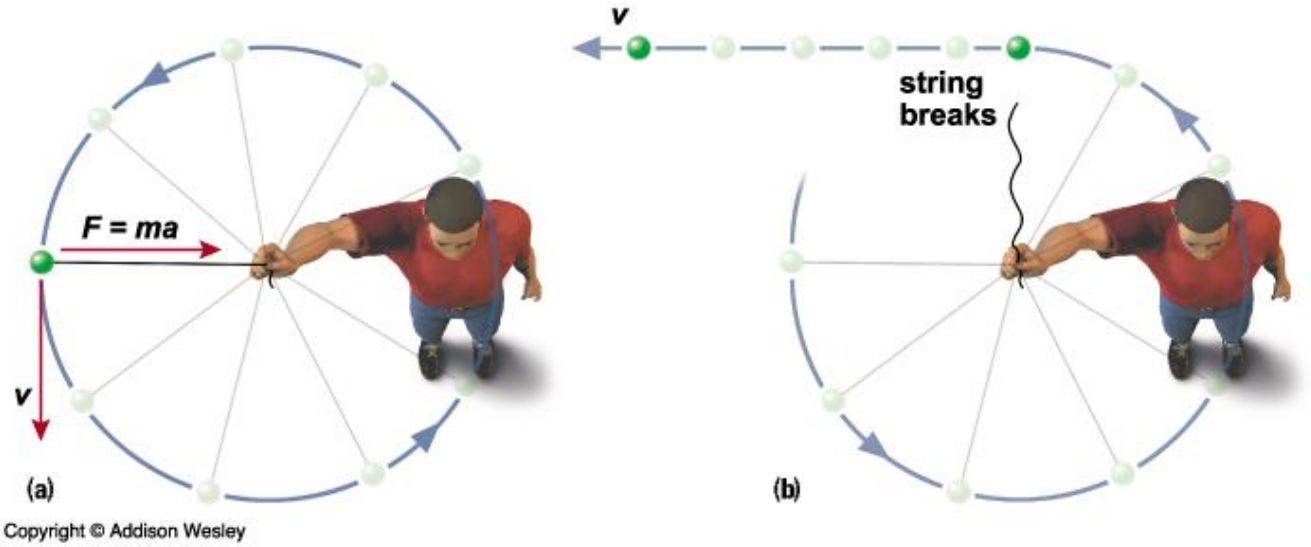
$\vec{F}_{cp}, \vec{a}_{cp} \perp \vec{F}_t, \vec{a}_t$

$\Downarrow$

$\Leftarrow$ v≠const.

$$F_{net} = \sqrt{F_{cp}^2 + F_t^2}$$

Examples 1:



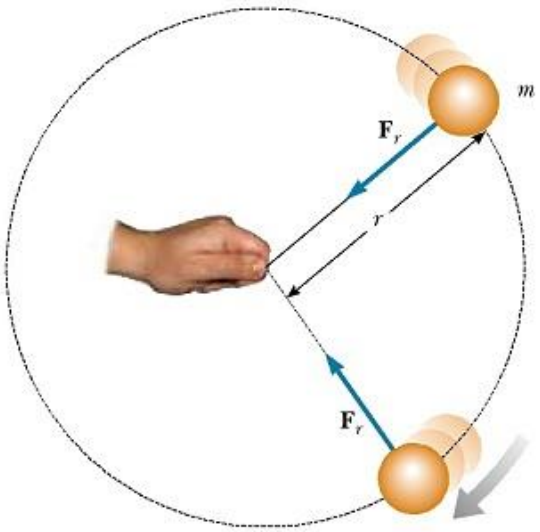
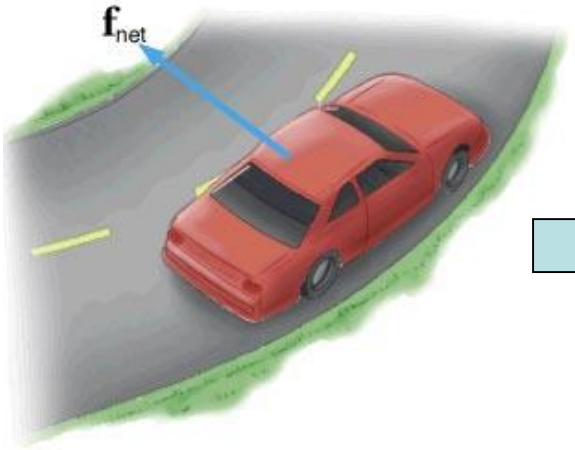
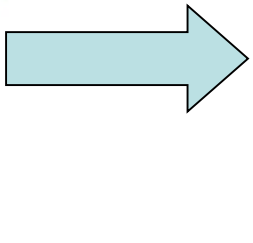


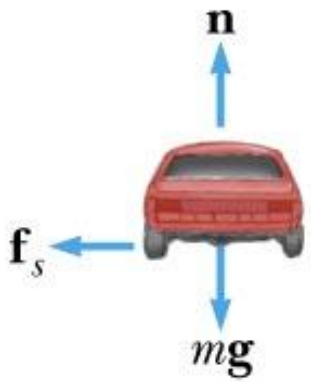
Figure 6.1 Overhead view of a ball moving in a circular path in a horizontal plane. A force $\mathbf{F}_r$ directed toward the center of the circle keeps the ball moving in its circular path.

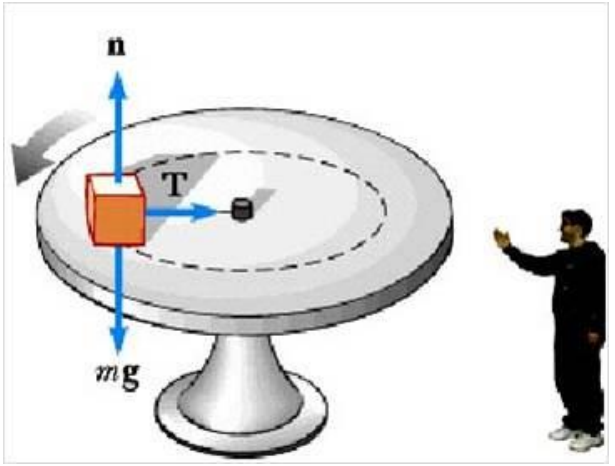
Tension ???

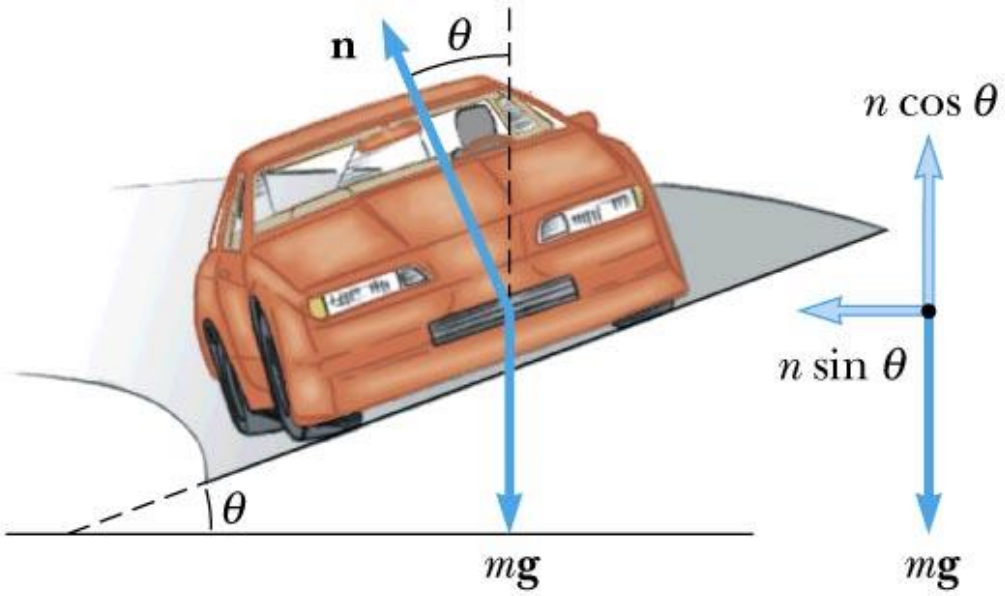
Examples 2:



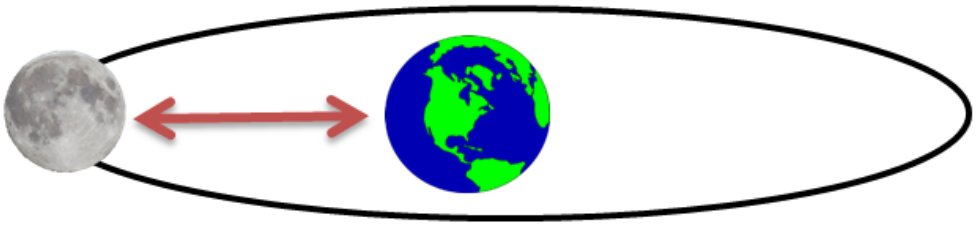




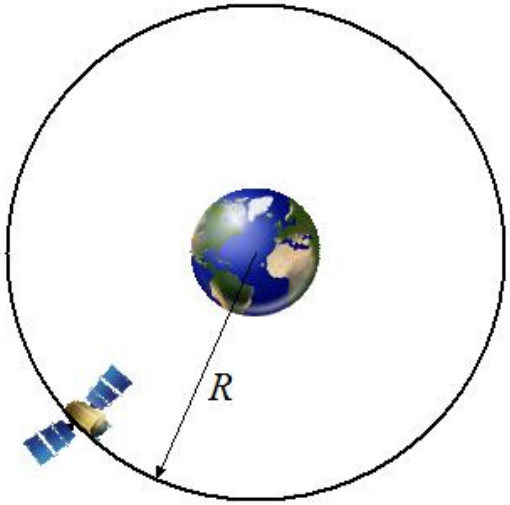


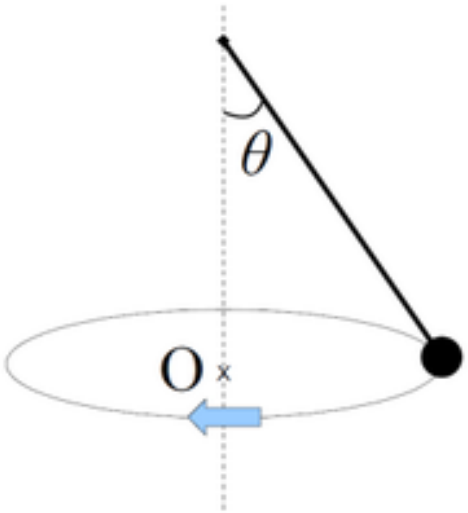


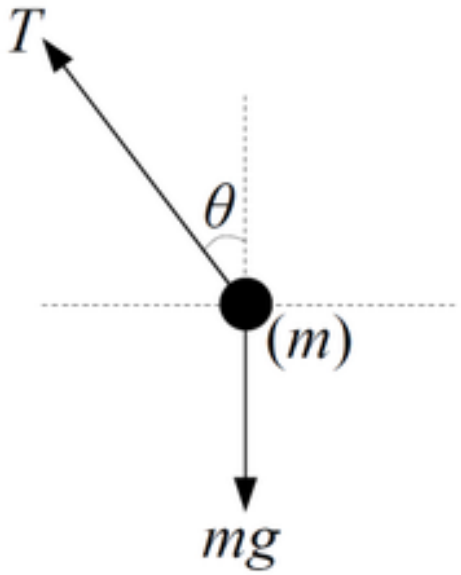
Examples 3:



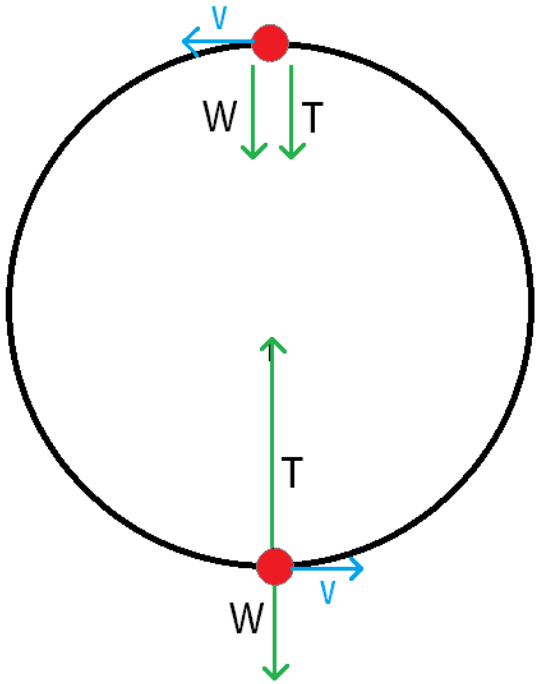
Example of Uniform Circular Motion

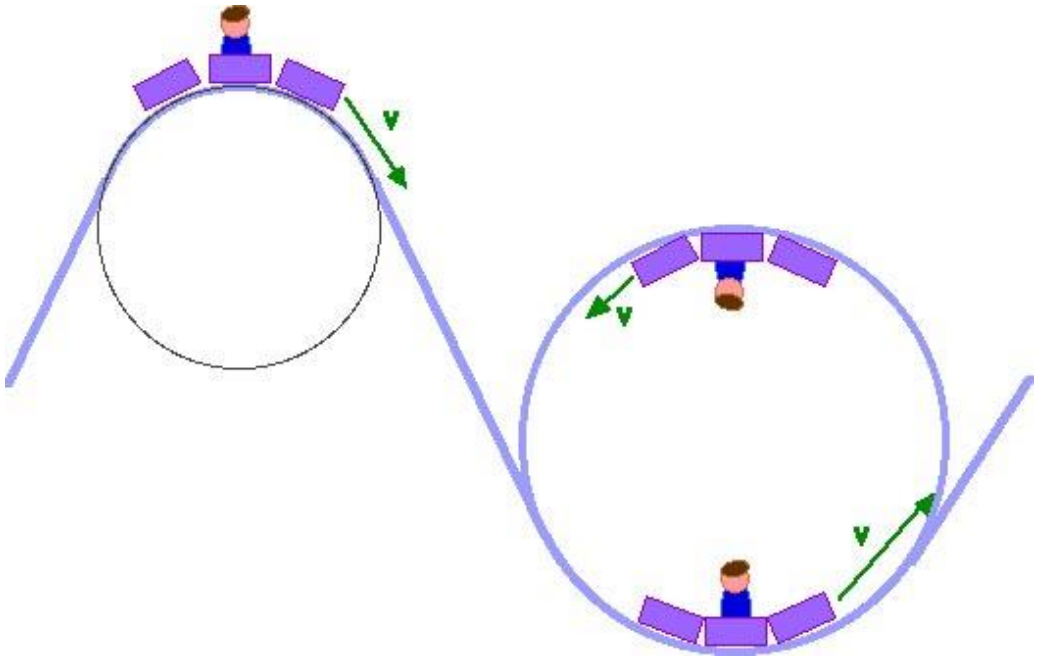


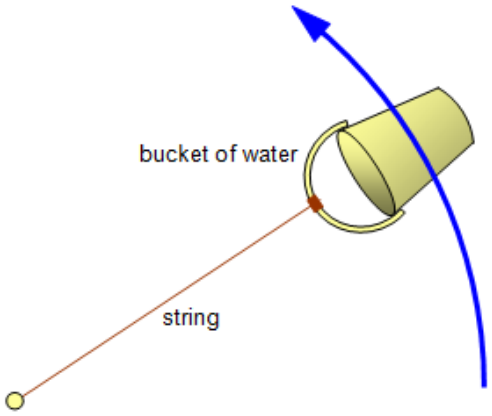


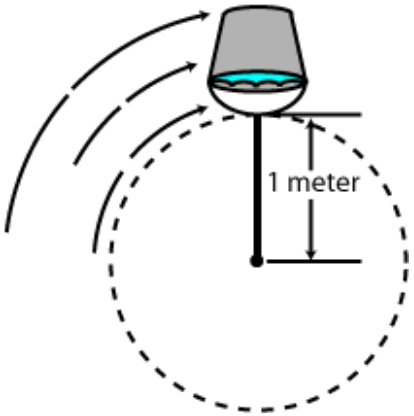


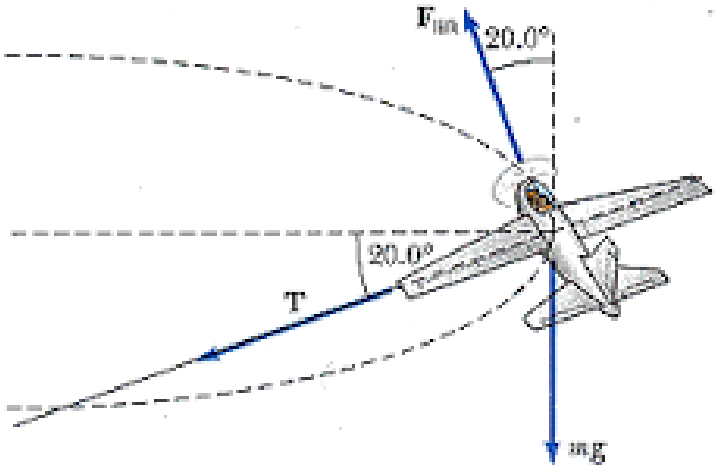
Examples 4:



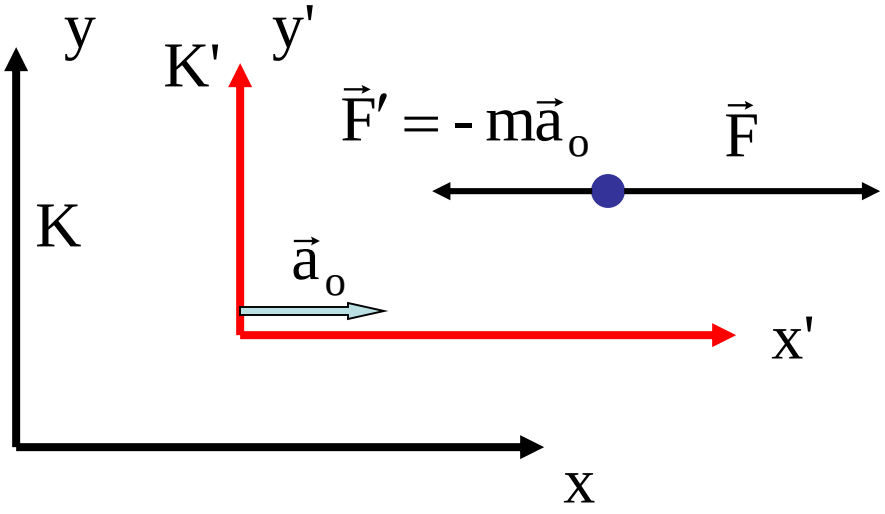








Motion in accelerated frames

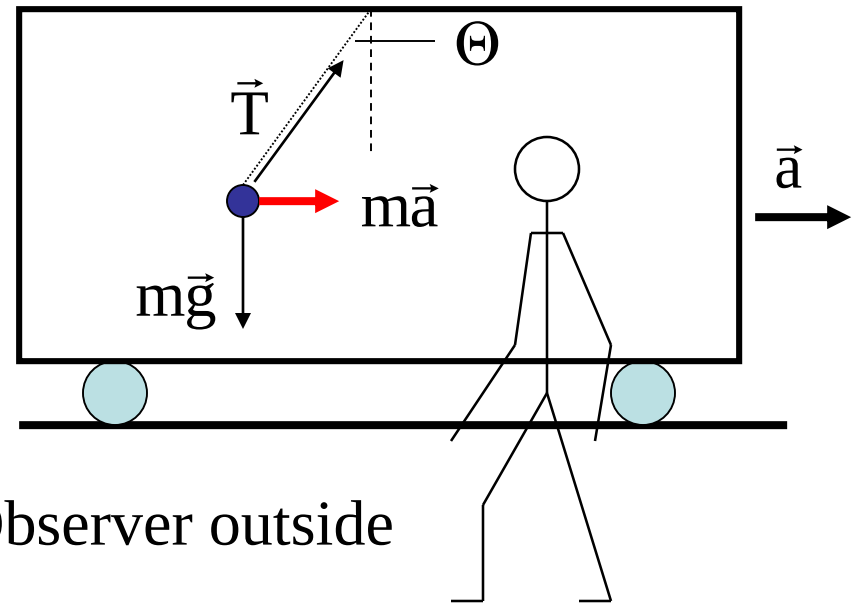


Forc in K: $\vec{F}_{net} = \vec{F} = m\vec{a}$

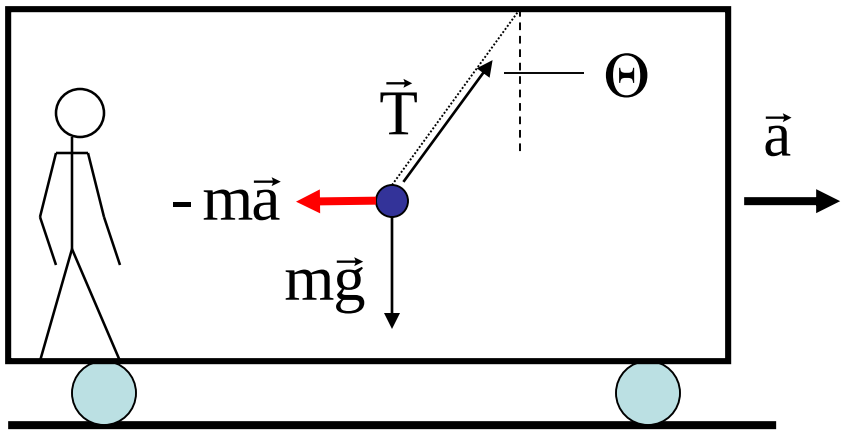
Forces in K':

$$\vec{F}_{net} = \vec{F} + \vec{F}' = m\vec{a} - m\vec{a}_o$$

$$\vec{a}_{K'} = \vec{a} - \vec{a}_o$$



Observer outside



Observer inside