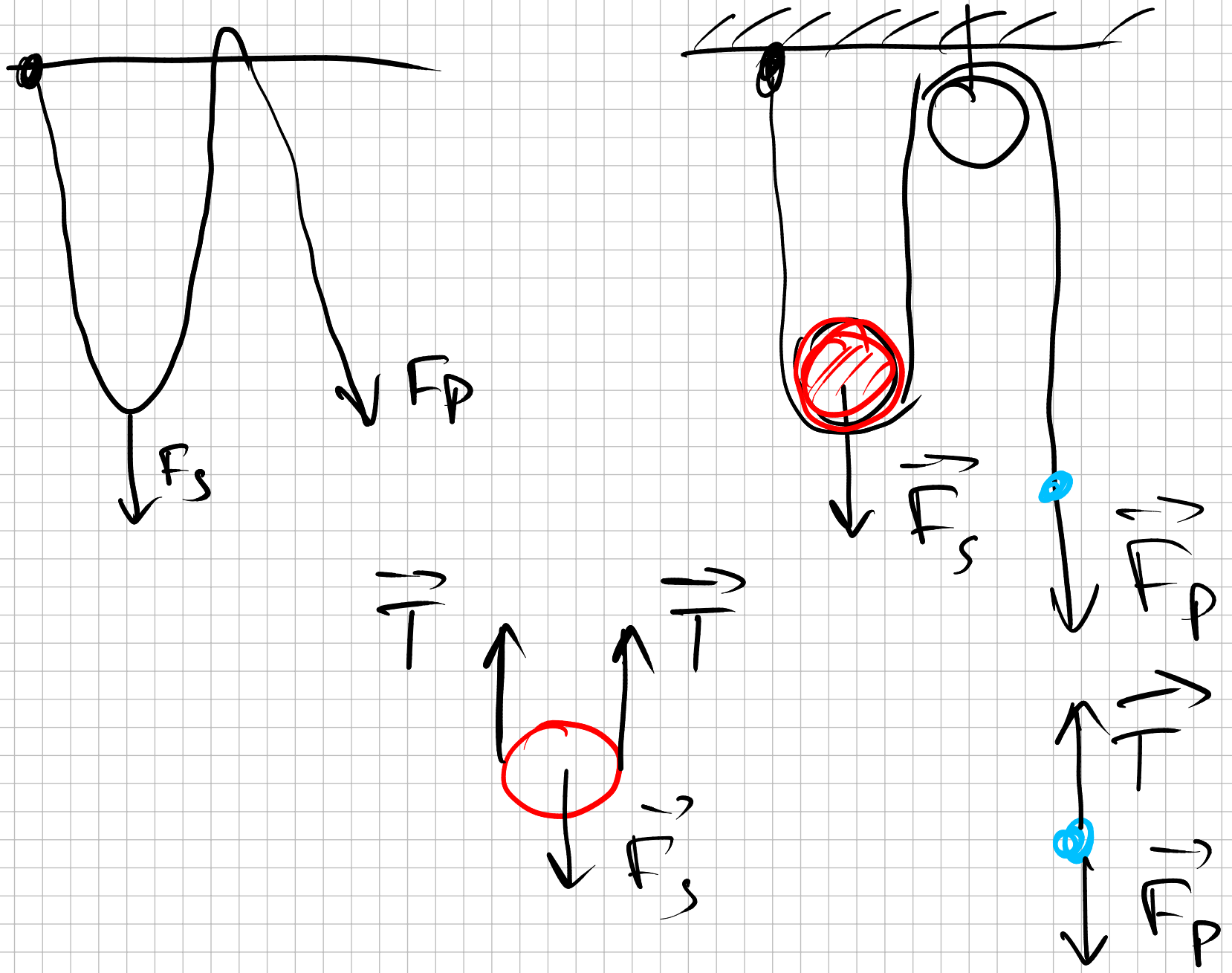
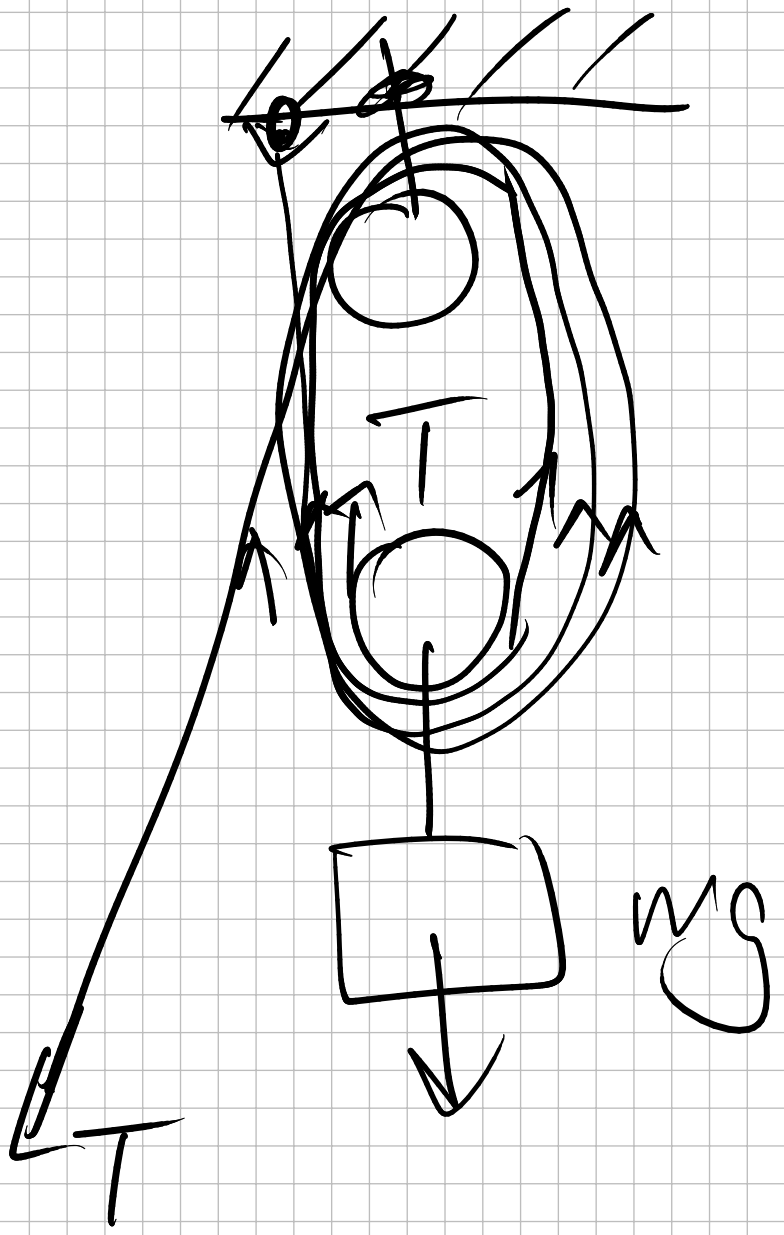
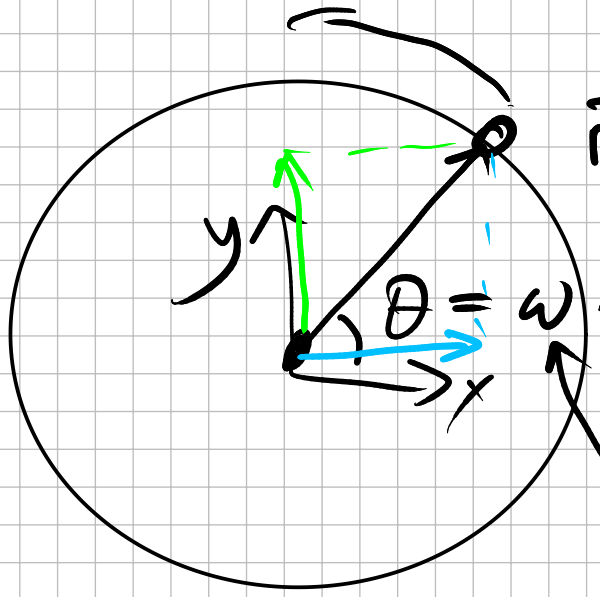

F_p
F_s
$\vec{F}_s$
$\vec{F}_p$
$\vec{T}$
$\vec{T}$
$\vec{F}_s$
$\vec{T}$
$\vec{F}_p$


T
mg
T

Uniform circular motion



$\vec{r} = r\cdot(\cos\theta)\hat{i} + r(\sin\theta)\hat{j}$

angular speed

$$\vec{v} = \frac{d\vec{r}}{dt} = \frac{d}{dt}\left(r\hat{i}\cos(\omega t) + r\hat{j}\sin(\omega t)\right)$$

$$= r\hat{i}\frac{d}{dt}(\cos\omega t) + r\hat{j}\frac{d}{dt}(\sin\omega t)$$

$\frac{d}{dx}\cos x = -\sin x$

$\frac{d}{dt}\cos(\omega t) = -\sin(\omega t)\frac{d\omega t}{dt}$

$= -\sin(\omega t)\cdot\omega$

$$\vec{v} = r\hat{i}(-\omega)\sin(\omega t) + r\hat{j}(\omega)\cos(\omega t)$$

$$|\vec{v}| = v = \sqrt{r^2(\omega)^2\sin^2\omega t + r^2(\omega)^2\cos^2(\omega t)}$$

$$= r\omega$$

$$\vec{v} \perp \vec{r} \iff \vec{v}\cdot\vec{r} = 0$$

$$= v_x \cdot r_x + v_y \cdot r_y$$

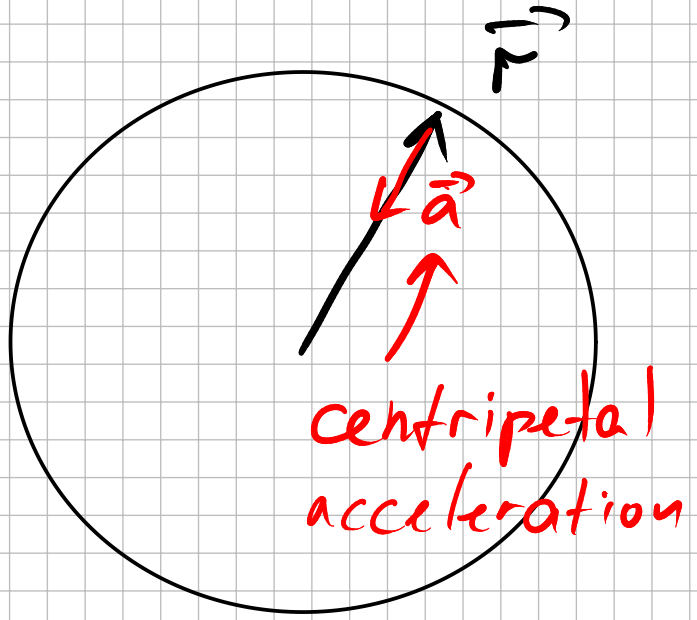
$$\vec{a} = \frac{d^2\vec{r}}{dt^2} = \frac{d}{dt}\left(\frac{d\vec{r}}{dt}\right) = \frac{d}{dt}\vec{v}$$

$$= \frac{d}{dt}\left(r\hat{i}(-\omega)\sin(\omega t) + r\hat{j}(\omega)\cos\omega t\right)$$

$$= r\hat{i}(-\omega^2)\cos(\omega t) + r\hat{j}(-\omega^2)\sin(\omega t)$$

$$\boxed{\vec{a} = -\omega^2\vec{r}}$$

$$a = |\vec{a}| = \omega^2 r = \frac{v^2}{r}$$

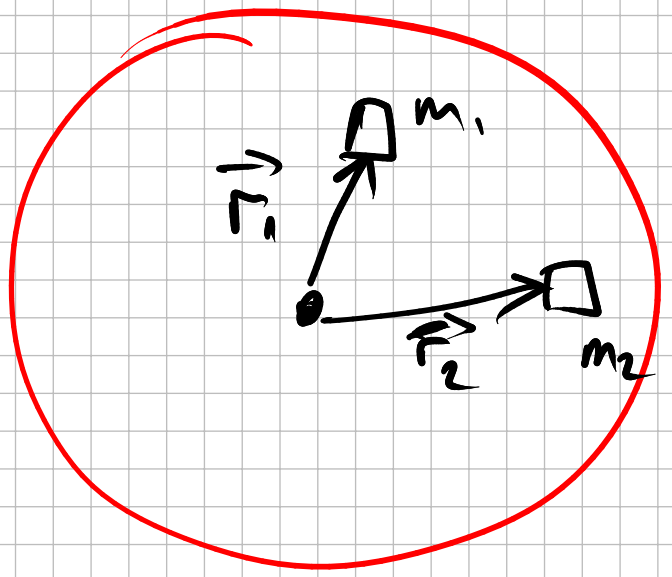


$$v = \frac{2\pi r}{T} = r \cdot \omega$$

$$\omega = \frac{2\pi}{T} = \left[\frac{rad}{s}\right]$$

period

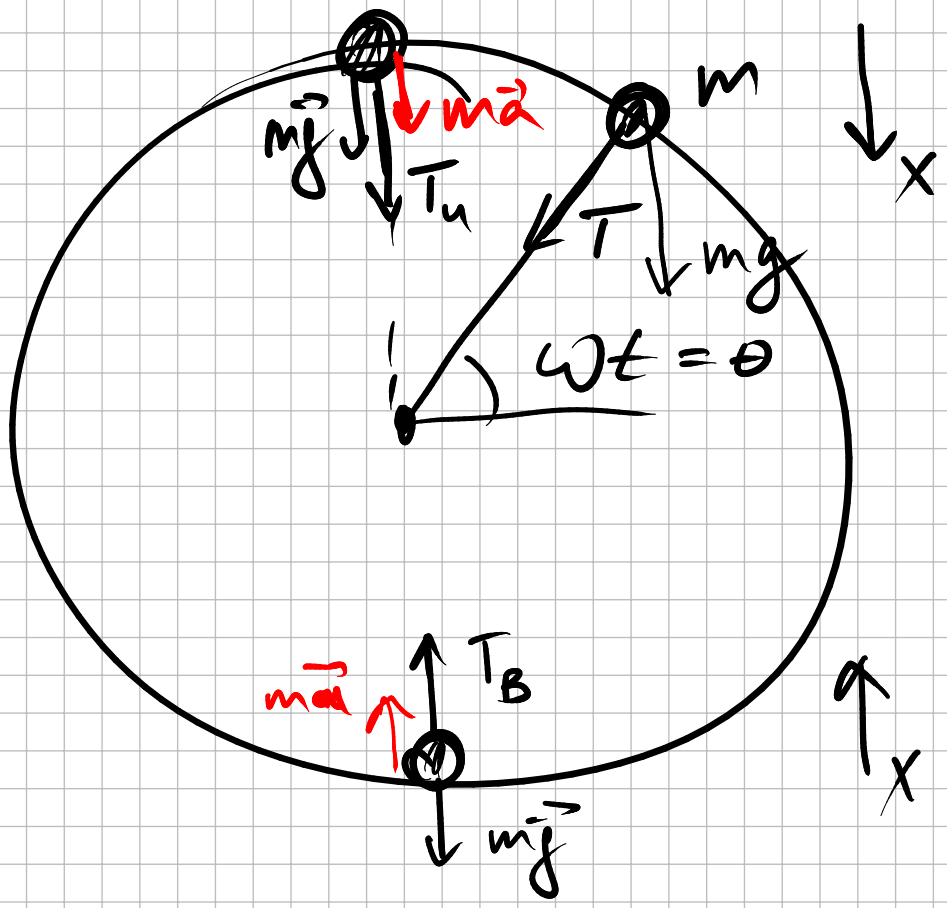
$$2\pi [rad] = 360°$$



$$ma = m\omega^2 r = \left|\vec{F}_{total}\right|$$

$$\mu N = \mu mg$$

$$m\omega^2 r = \mu mg$$



$$ma_x = mg + T_u$$

$$ma_x = T_B - mg$$

$$T_B = ma + mg$$

$$T_u = ma - mg$$