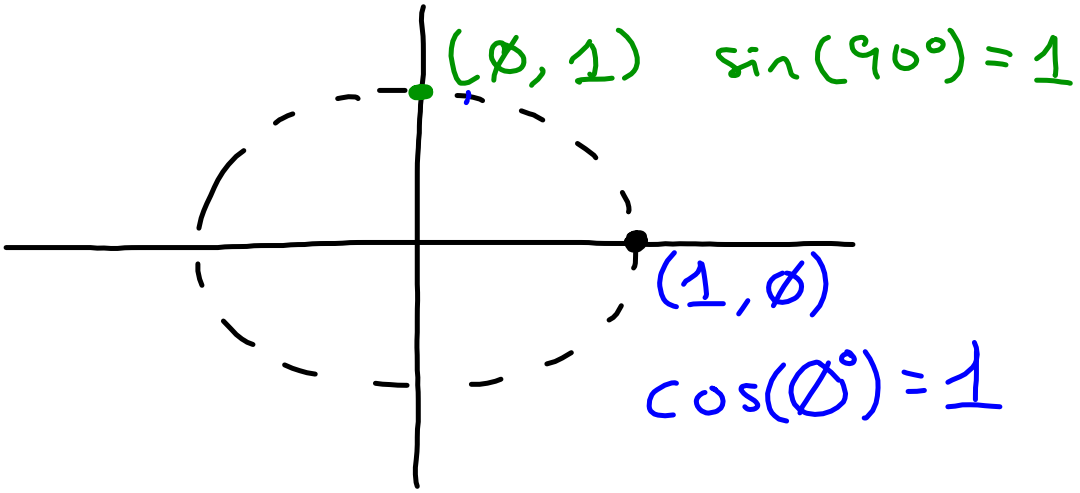
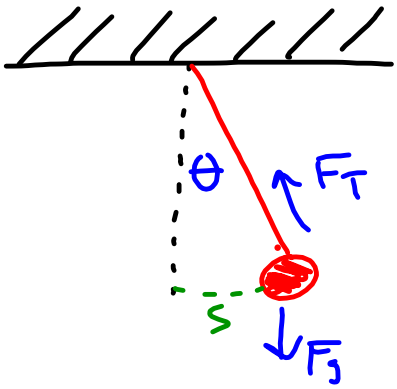

(0, 1)
sin(90°) = 1
(1, 0)
cos(0°) = 1

Simple Pendulum



$F_{Tx} = ma$

s = arc length

$-m a_g \sin\theta = m \frac{d^2 s}{dt^2}$ $\quad s = L\theta$

for small angles ($< 10^\circ$)

$$\frac{d^2\theta}{dt^2} = -\frac{a_g}{L}\sin\theta$$

SMALL ANGLE APPROXIMATION

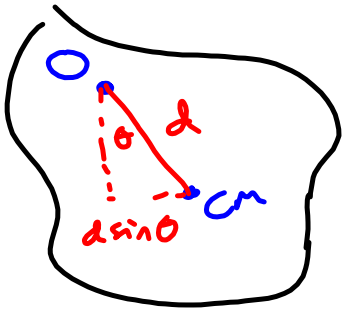
$$\theta \approx \sin\theta$$

$$\frac{d^2\theta}{dt^2} = -\frac{a_g}{L}\theta$$

$$\omega = \sqrt{\frac{a_g}{L}}$$

$$T = 2\pi\sqrt{\frac{L}{a_g}}$$

Physical Pendulum



$$-Mg\,d\sin\theta = I\frac{d^2\theta}{dt^2}$$

for small angles $\sin\theta \approx \theta$

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

ω^2

can solve from here

$$T = 2\pi\sqrt{\frac{I}{mgd}}$$

Torsional Pendulum

$$\tau = -k\theta$$

θ → angle

k → torsion constant

τ → torque

$$\sum \tau = I\alpha$$

$$-k\theta = I\frac{d^2\theta}{dt^2}$$

$$\frac{d^2\theta}{dt^2} = -\frac{k}{I}\theta$$

$$T = 2\pi\sqrt{\frac{I}{k}}$$