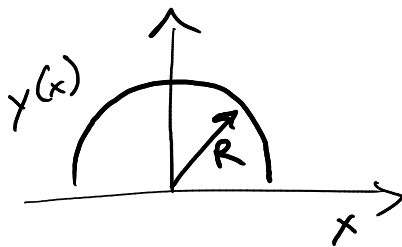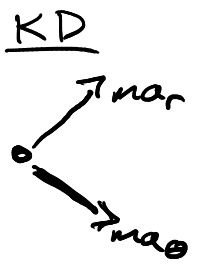$$\theta << 1$$
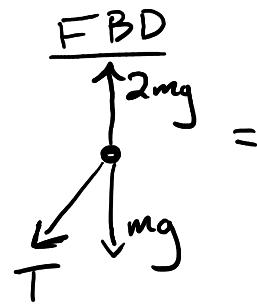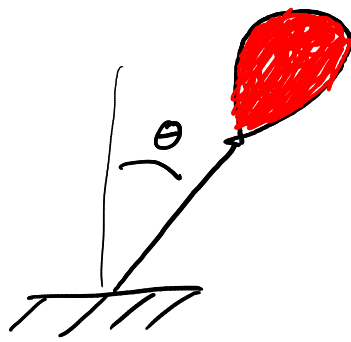
$$\cos\theta = 1$$

$$mg\cos\theta - N = \frac{mv^2}{\rho}$$

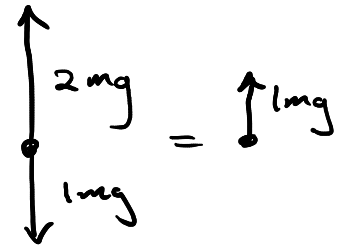$$y = \sqrt{R^2 - x^2}$$

$$slope = \frac{dy}{dx} = \frac{-x}{\sqrt{R^2 - x^2}}$$

$r = \rho = 100m$

FBD

$\uparrow 2mg$

$=$

KD

$\nearrow mar$

$\searrow ma_\theta$

$\swarrow T$ $\downarrow mg$

eom

$$\ddot{\theta} = f(\theta)$$

$2mg \uparrow \quad \downarrow 1mg \quad = \quad \uparrow 1mg$

$\hat{e}_r \Rightarrow \quad -T + mg\cos\theta = m(-r\dot{\theta}^2)$
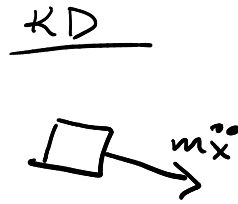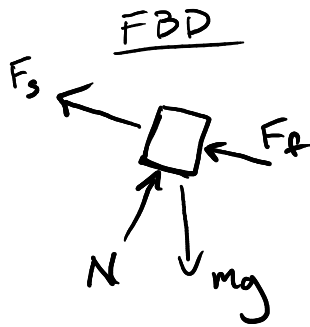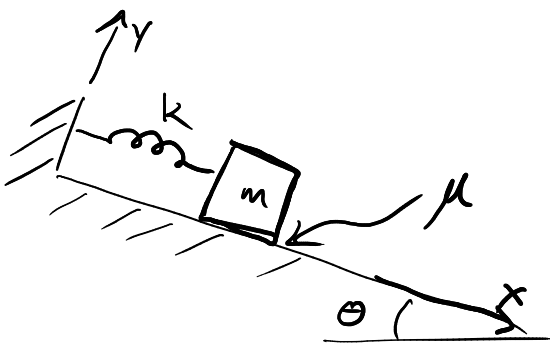
$\hat{e}_\theta \Rightarrow \quad -mg\sin\theta = m(r\ddot{\theta})$

if $\theta = \dfrac{\pi}{4} = 45°$

$$\boxed{\ddot{\theta} = -\dfrac{g}{r}\sin\theta}$$ eom

$\ddot{\theta} = -\dfrac{g}{r}\sin\dfrac{\pi}{4} = -\dfrac{g}{r} \cdot \dfrac{\sqrt{2}}{2}$

y

k

m

μ

θ

x

FBD

KD

F_s

F_f

N

mg

$m\ddot{x}$

$$F_f = \mu N \cdot \frac{\dot{x}}{|\dot{x}|}$$

eom

$$\ddot{x} = -\mu g \cos\theta - \frac{k}{m}x + g\sin\theta$$