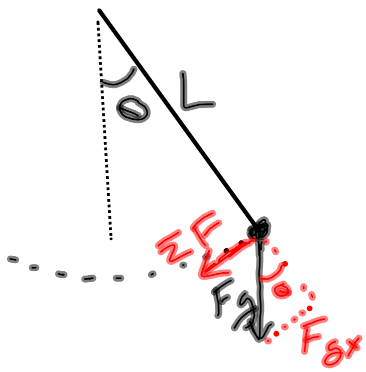
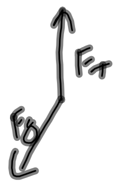
Pendulums

Goal: write a differential equation that is similar to

$$a = -\omega^2 x$$





$a = \frac{\Sigma F}{m}$

$\Sigma F = ma$

$\Sigma F = F_{gx} = -F_g \sin(\theta)$

$\cancel{m}a = -\cancel{m}g \sin(\theta)$

mass doesn't matter in pendulums and that's super duper neat-o

$V = r\omega$ ← angular velocity

$a = r\alpha$ ← angular acceleration

(r → L)

$a = -g \sin(\theta)$

↙ linear ↘ angular

$L\alpha = -g \sin(\theta)$ (L: radius of pendulum swing)

$\alpha = -\frac{g}{L} \sin(\theta)$

when $\theta < 1$, $\sin(\theta) \approx \theta$

$(a = -\omega^2 x)$ $\alpha = -\frac{g}{L} \theta$

$\omega^2 = \frac{g}{L}$ $\omega = \sqrt{\frac{g}{L}}$

$$\boxed{T_{pendulum} = 2\pi\sqrt{\frac{L}{g}}}$$

$T = \frac{2\pi}{\omega}$

$T = \frac{2\pi}{\sqrt{\frac{g}{L}}} \cdot \frac{\sqrt{\frac{L}{g}}}{\sqrt{\frac{L}{g}}}$ $T = 2\pi\sqrt{\frac{L}{g}}$

Driven Oscillation

Oscillation caused by an outside force

Natural Frequency

Frequency of oscillation when pushed once and allowed to swing

Resonance