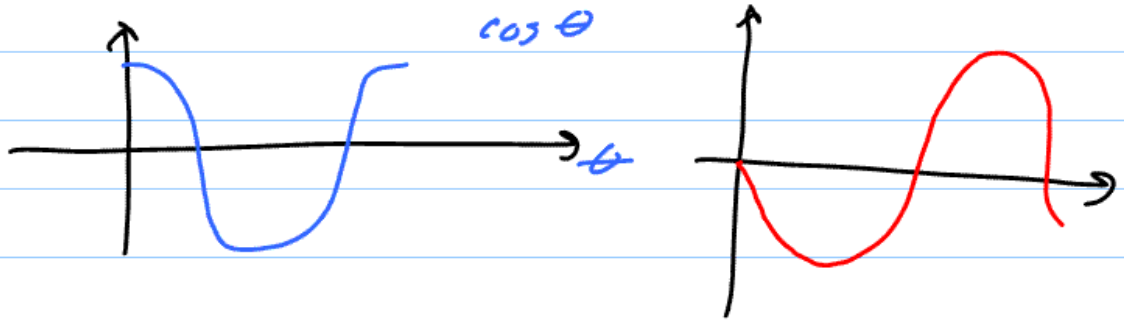
PHY138 - Mechanics - Class 8 - Oct 4/06

Some Math

MAT135 gets to this week of Oct 30.

Derivatives of trig functions

$$\frac{d \sin\theta}{d\theta} = \cos\theta$$



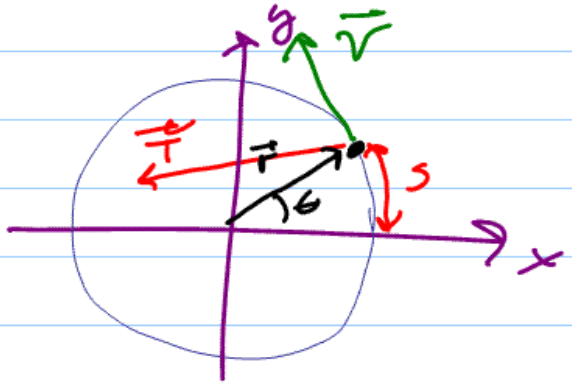
$$\frac{d \cos\theta}{d\theta} = -\sin\theta$$

§7.5. Fictitious Forces

Inertial (non-accelerating) Frames

No fictitious forces.

§7.6 - Nonuniform ⊙ Motion



$$\vec{T} = T_r \hat{r} + T_t \hat{t}$$

causes speed to increase

Eqns 2.18, 2.22

$$\begin{cases} s_f = s_i + v_{ti}\,\Delta t + \frac{1}{2} a_t (\Delta t)^2 \\ v_f = v_i + a_t \Delta t \end{cases}$$

Divide by r

$$\begin{cases} \theta_f = \theta_i + \omega_i \Delta t + \frac{1}{2} \frac{a_t}{r} (\Delta t)^2 \\ \omega_f = \omega_i + \frac{a_t}{r} \Delta t \end{cases}$$

(From chapt 13) angular acceleration $\alpha \equiv \frac{a_t}{r}$

"alpha"

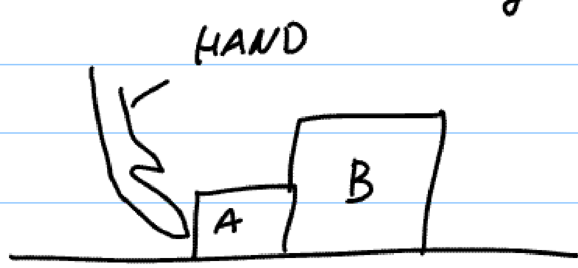
$$\theta_f = \theta_i + \omega_i \Delta t + \frac{1}{2}\alpha (\Delta t)^2$$

$$\omega_f = \omega_i + \alpha \Delta t$$

CHAPTER 8

Series of examples:

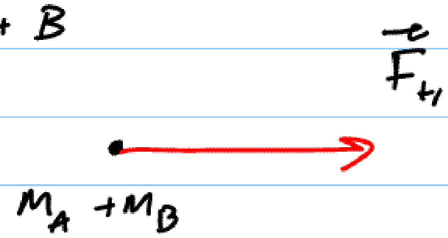
For all: model as a particle
ignore vertical forces



frictionless

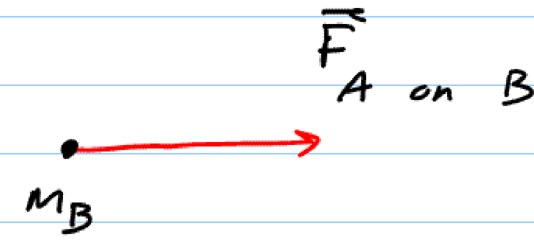
System: A + B

FBD



$$\underline{a} = \frac{F_{net}}{M_{tot}} = \frac{F_H}{m_A + m_B}$$

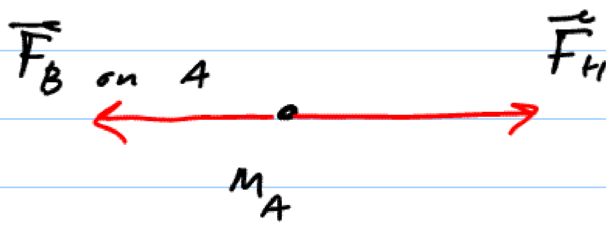
<u>System:</u> B



$$a = \frac{F_{A \text{ on } B}}{m_B} = \frac{F_H}{m_A + m_B}$$

$$F_{A \text{ on } B} = m_B \frac{F_H}{m_A + m_B}, \text{ right}$$

<u>System A</u>



$$a = \frac{F_H - F_{B \text{ on } A}}{m_A} \quad \overset{\text{algebra}}{\Longrightarrow}$$

$$F_{B \text{ on } A} = m_B \frac{F_{LI}}{m_A + m_D}, \text{ left}$$

$$\vec{F}_{B \text{ on } A} = -\vec{F}_{A \text{ on } B}$$

3rd Law

Always true