TAM 212: Class 32 – Sir Isaac Newton

$$\vec{F} = m\vec{a}$$

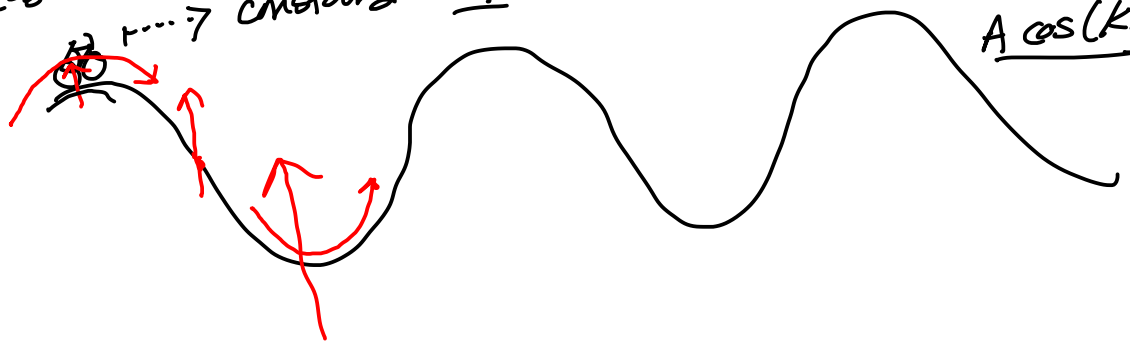
2 ways to use $\vec{F} = m\vec{a}$

→ (1) Method of Assumed Forces: assume $\vec{F}$ ⟹ find path

→ (2) Method of Assumed Motion: assume path ⟹ find external $\vec{F}$ that must be acting to cause the motion

last time ⋯→ constant v_x

$A\cos(kx)$



APPROACH

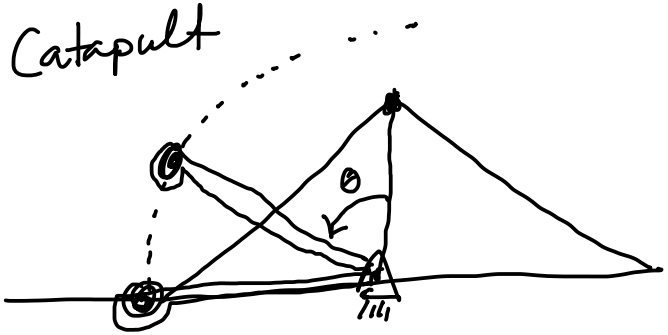
A) FBD

B) Kinematics

C) $\vec{F} = m\vec{a}$

D) Algebra

Ex) Catapult

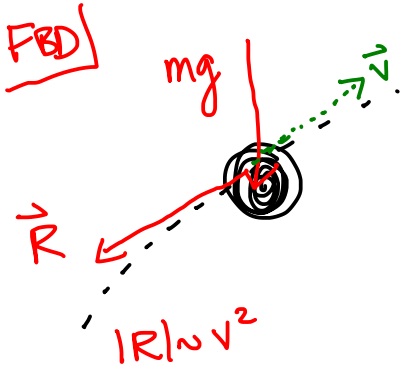


Given Release Angle θ, release speed

Find horizontal distance covered.

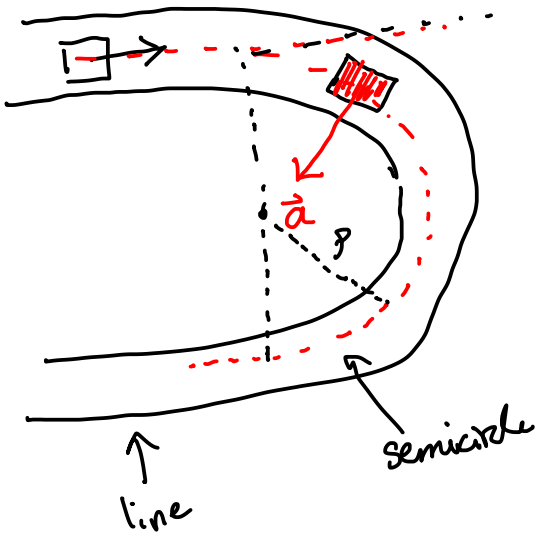
is this (A) Method of Assumed Forces

(B) " Motion



Method of Assumed Forces

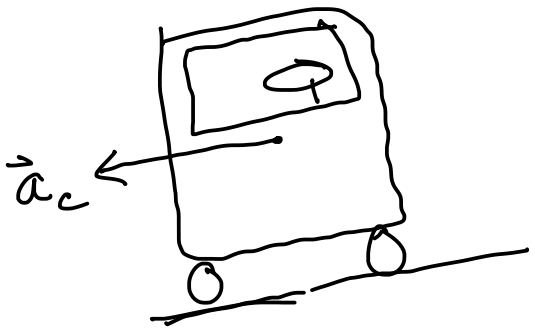
CORNERING / BANKED TURNS



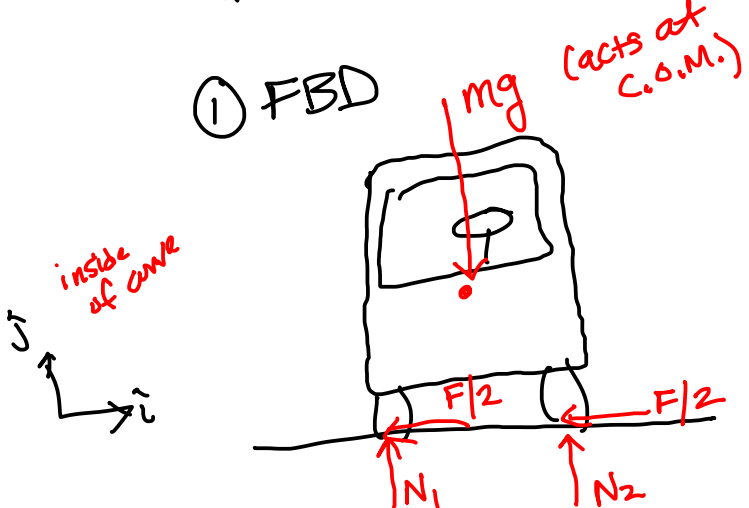
- car travels at a const. speed around the curve, v
- inside the curve $\vec{a}$ is non-zero

$\Rightarrow$ there must be some external forces acting on the car to give it the $\vec{a}$

Resultant Motion
- draw accelerations at C.O.M



① FBD



Notice: Friction of Road provides the force needed for the acceleration

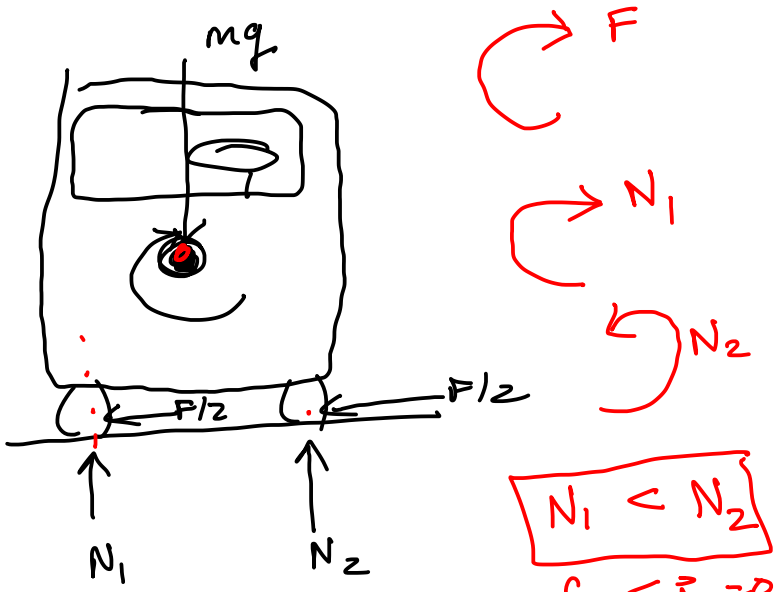
② Kinematics

$$\vec{a}_c = \frac{-v^2}{\rho}\hat{r}$$

③ Newton:

$$\sum \vec{F} = m\vec{a}$$

$$\sum \vec{M}_c = 0 \Rightarrow$$ to avoid tipping over



$N_1 < N_2$ for $\sum \vec{M}_c = 0$

3 eq's, 3 vars! F, N_1, N_2

④ Algebra .... solve for F, N_1, N_2

Two bad things can happen

① if $F > \mu(N_1 + N_2)$ then force of friction isn't sufficient to provided the needed F

② the car might roll over