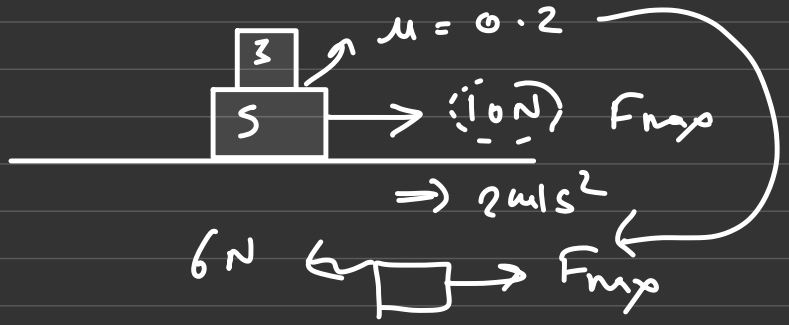
Dynamics 3


VMC
Vidyamandir
Classes
SINCE 1986
IIT JEE | MEDICAL | FOUNDATION

6)



□ → $f_s = \mu_s N$

$= 0.2(3 \times 10)$

$= 0.6 \times 10$

$= 6N$

$6N = 3 \times a_{max}$

$a_m = 2 m/s^2$

F_{max} for which both moves together

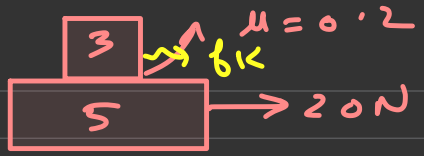
$F_{max} - 6N = 5 \times 2$

$F_{max} = 10 + 6 = \underline{\underline{16N}}$

$F \leq f_{max}$

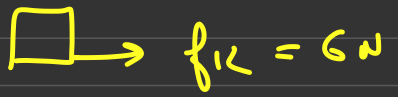
both moving together

#



$f > 16N$

$\Rightarrow a_1$



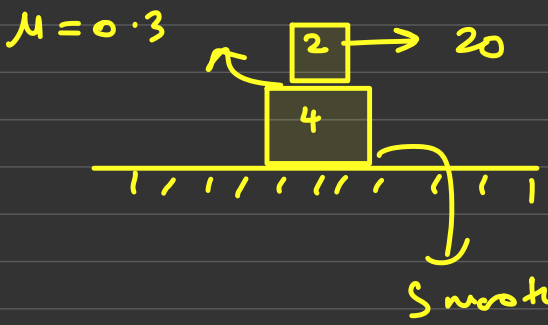
$6 = 2 \times a_1 \Rightarrow a_1 = 2 m/s^2$

$\Rightarrow a_2$

$a_1 = \frac{20 - 6}{5}$

$a_1 = \frac{14}{5} = 2.8 m/s^2$

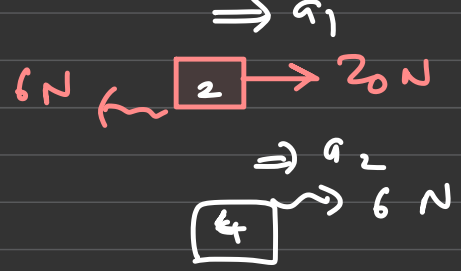
Q)



find acceleration of blocks?

"

① Assume both are slipping over each other "



$f_k = \mu_k N$

$= 0.3 \times (2 \times 10)$

$= 6\ N$

② Calculate acceleration of both block

$$\begin{cases} a_1 = \dfrac{20-6}{2} = 7\ m/s^2 \\ a_2 = \dfrac{6}{4} = 1.5\ m/s^2 \end{cases}$$

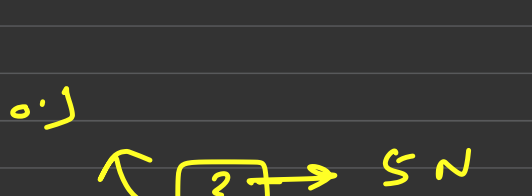
$\{a_1 =$ jisper force I org Rule

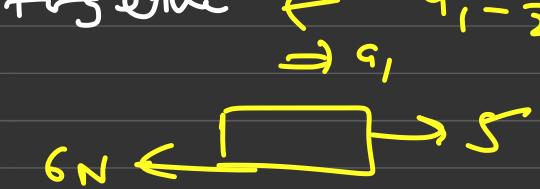
\# if $a_1 > a_2$ then ans correct

if $a_1 < a_2$ then both are moving together $\leftarrow$ $a_1 = \frac{1}{2}\ m/s^2$

$\Rightarrow a_1$

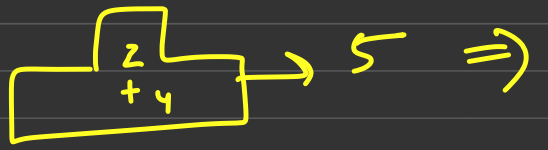
$M = 0.1$





$a_2 = \dfrac{6}{4} = 1.5\ m/s^2$

" $a_1 < a_2$ hence both moving together "



$\Rightarrow$ $5 = 6 \times a$

$a = \frac{5}{6}\ m/s^2$

$\Rightarrow 5/6$

$5 - f = 2 \times \frac{5}{6}$

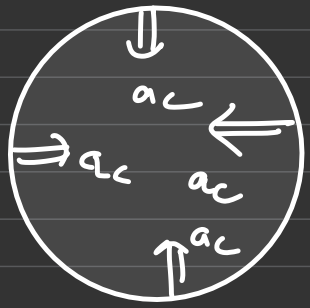
$f = 5 - \frac{10}{6}$

$f = 10/3\ N$

2D motion

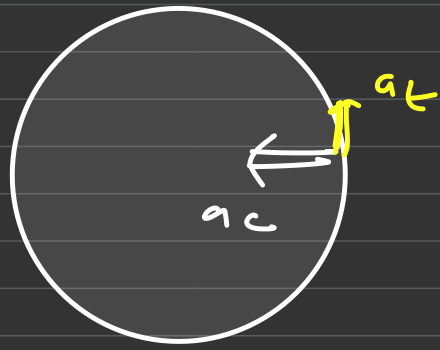
: Circular Motion :

(1) Uniform Circular motion



$$a_c = \omega^2 R = \frac{v^2}{R}$$

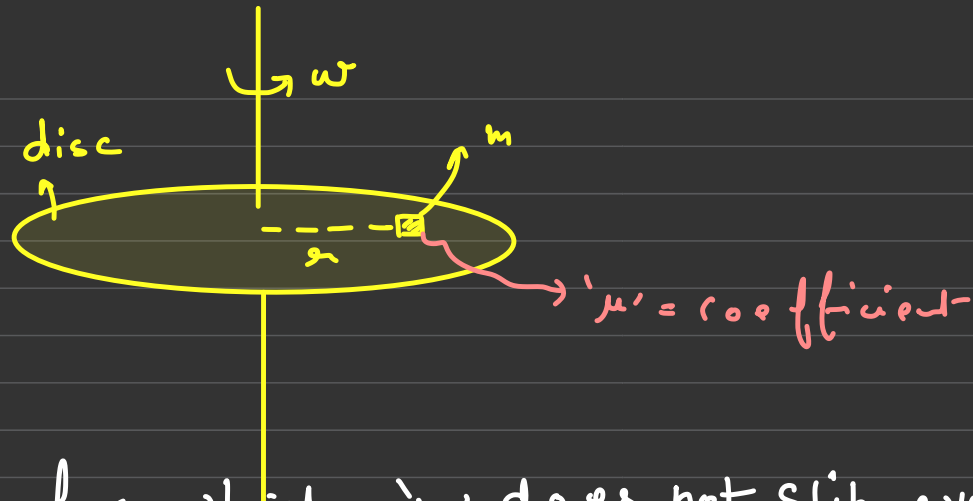
(2) Non-Uniform Circular motion



force acting towards centre of circle is called Centripetal force

{"frictional force} is value of force"

Ex #:



① find ω_{max} $\Longleftrightarrow$?? for which 'm' does not slip over disc?

Assume first, disc is rotating with ω and 'm' is not slipping over it.

$\Rightarrow \quad f = m a_c$

$\uparrow f = m (\omega^2 r)$

$\omega \uparrow \quad a_c \uparrow$

$f \uparrow$

$f_s = m (\omega_{max}^2 r)$

$\omega > \omega_{max}$ then it will

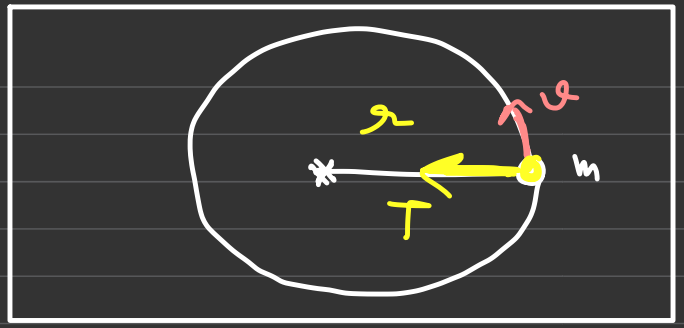
$\uparrow$

$\mu_s m g = m \omega_{max}^2 r$

$\omega_{max} = \sqrt{\frac{\mu_s g}{r}}$

$\omega > \omega_{max}$ then it will slip over it

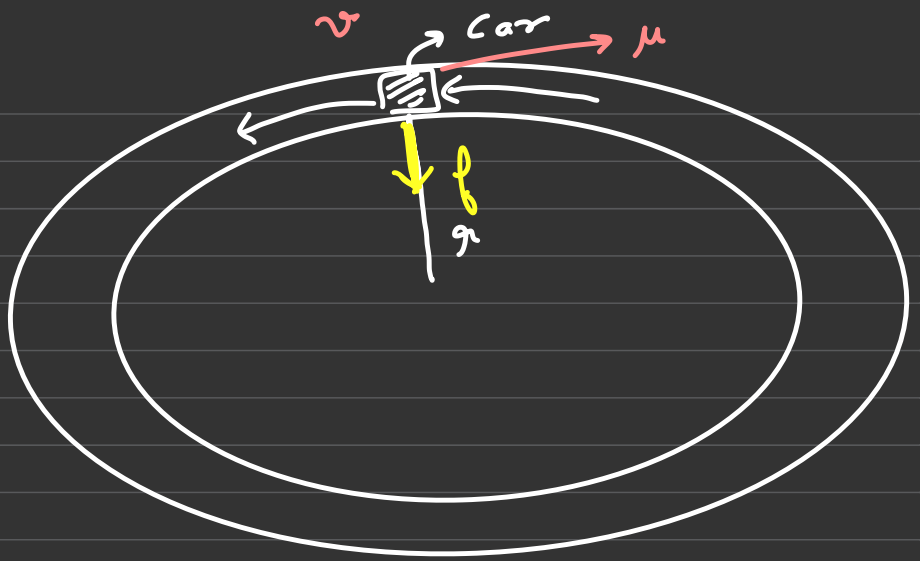
9)



$T = \frac{mv^2}{r}$

Centripetal force

6)



$$\Rightarrow f = mac$$

$$f = \frac{mv^2}{r}$$

$$f_s = \frac{m v_{max}^2}{r}$$

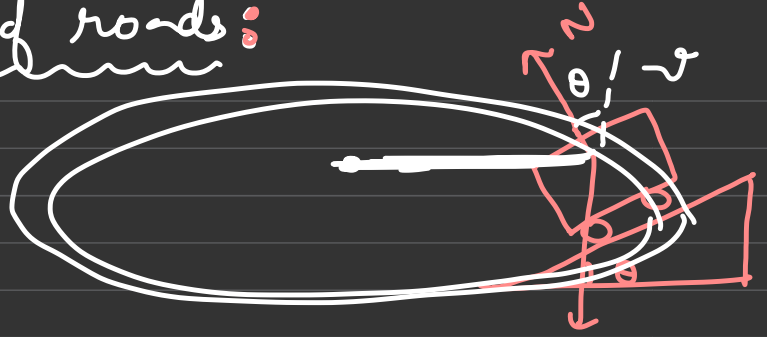
$$(\mu_s N) = m \frac{v_{max}^2}{r}$$

$$\mu_s (mg) = m \frac{v_{max}^2}{r}$$

$$v_{max} = \sqrt{\mu_s g r}$$

v_{max} ↙ Max Speed at which we can drive safely" with slipping

Banking of roads:



"Lets assume friction is not there"

$$(N\sin\theta) = mac \quad \text{(I)}$$

$$N\cos\theta = mg \quad \text{(II)}$$

$$\tan\theta = \frac{ac}{g}$$

$$\Rightarrow \frac{v^2}{rg} = \tan\theta$$

$$v = \sqrt{rg\tan\theta}$$

"This is velocity with which car can turn safely"

Q) if in case of banking, there is friction then find speed to safe drive?

{ V_{max} to safe drive

{ V_{min} to safe drive

$V_{min} < V < V_{max}$

V_{max} ?

$$f_s \cos\theta + N\sin\theta = \frac{m V_{max}^2}{r}$$

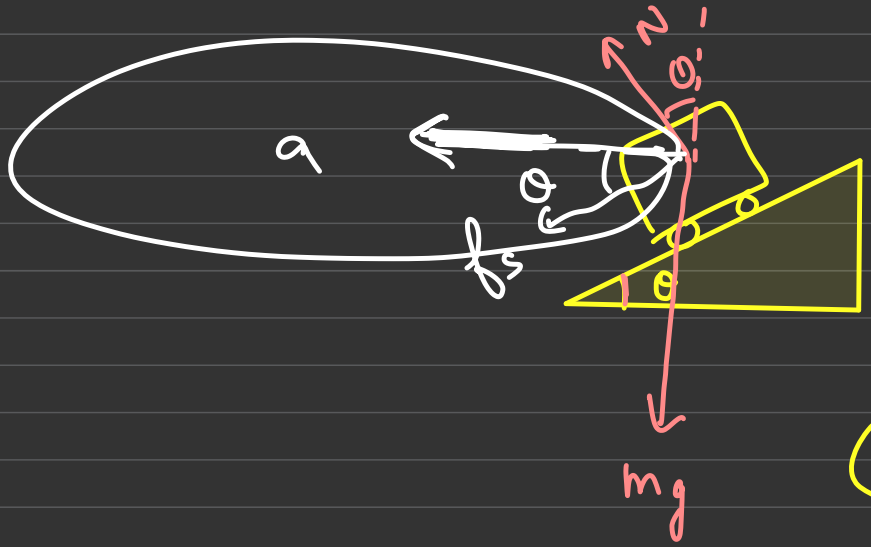
$$N\cos\theta = f_s \sin\theta + mg$$

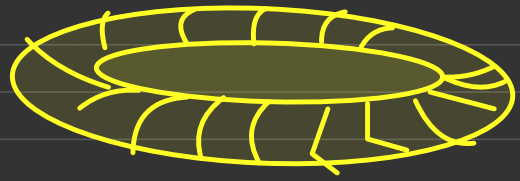
$$\mu_s N\cos\theta + N\sin\theta = \frac{m V_{max}^2}{r} \quad \text{(I)}$$

$$N\cos\theta - \mu_s N\sin\theta = mg \quad \text{(II)}$$

$$\frac{\mu \cos\theta + \sin\theta}{\cos\theta - \mu \sin\theta} = \frac{v_{max}^2}{rg}$$

$$v_{max} = \sqrt{rg\left(\frac{\sin\theta + \mu\cos\theta}{\cos\theta - \mu\sin\theta}\right)}$$





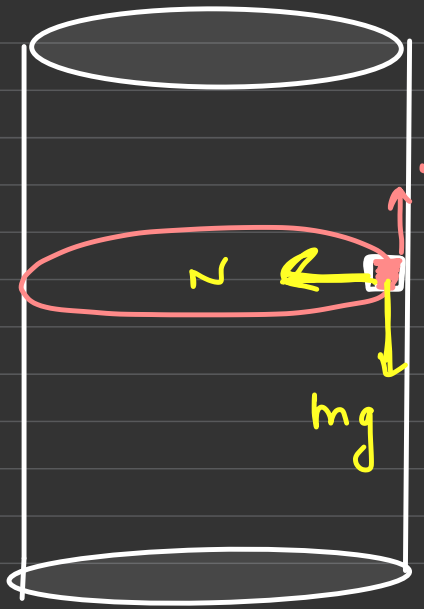
$$N\sin\theta + f_s\cos\theta = \frac{mv_{min}^2}{r}$$

$v_{min} = ?$

H.W

8)

find min velocity at which drive can safe drive over it.



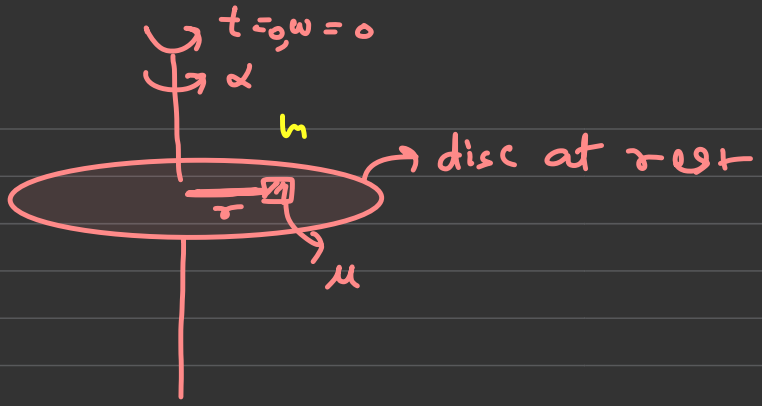
$$N = \frac{mv_{min}^2}{r} \quad -(I)$$

$$f_s = mg \quad -(II)$$

$$\mu_s\left(\frac{mv_{min}^2}{r}\right) = mg$$

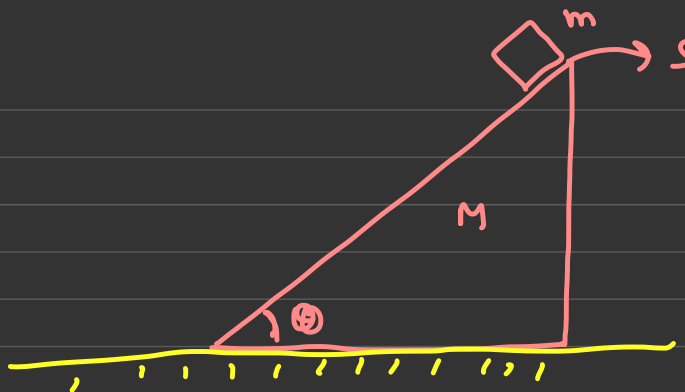
$$\underline{\underline{V_{min} = \sqrt{\frac{rg}{\mu_s}}}}$$

Homework:



find time after which block starts slipping?

#0#



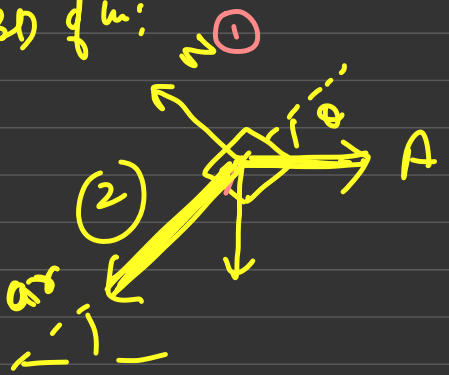
"initially both are at rest"

find acceleration of blocks?

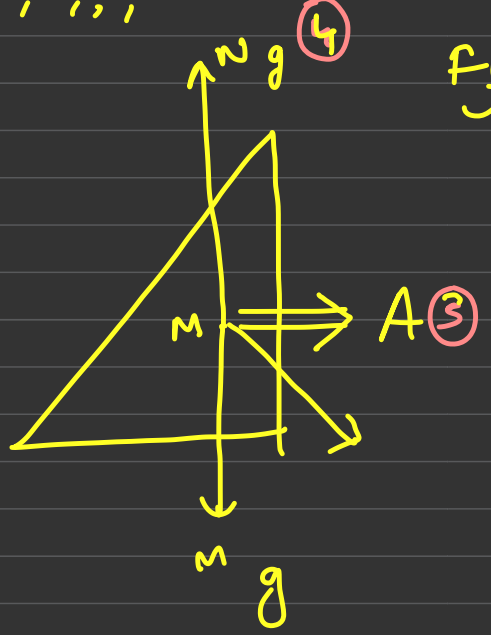
by default we have angular acc. w.r.t ground!

①

FBD of m:



FBD of M



(ii) Draw acceleration diagram { w.r.t ground }

{ Newtons $F=ma$ Valid w.r.t ground frame only }

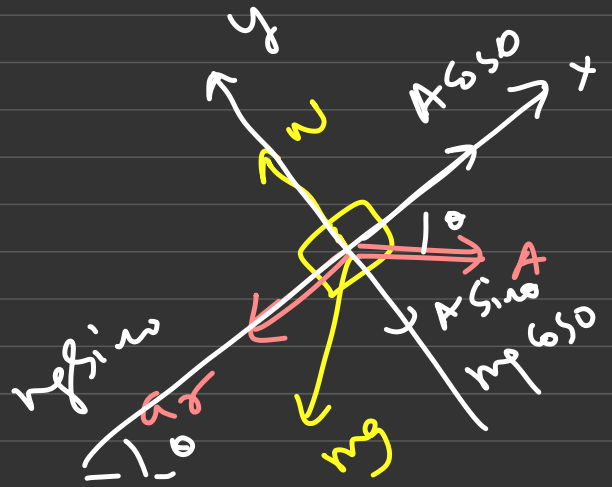
Statement A_3: "if a block is accelerating over accelerating block then its relative acceleration must be along the surface"

"$\vec{a}_r = \vec{a}_{mM}$ must be along the surface"

w.r.t

$$\{\vec{a}_r = \vec{a}_{mM} = \vec{a}_m - \vec{a}_M$$

$$\{ \quad \vec{a_m} = \vec{a_r} + \vec{a_m}$$

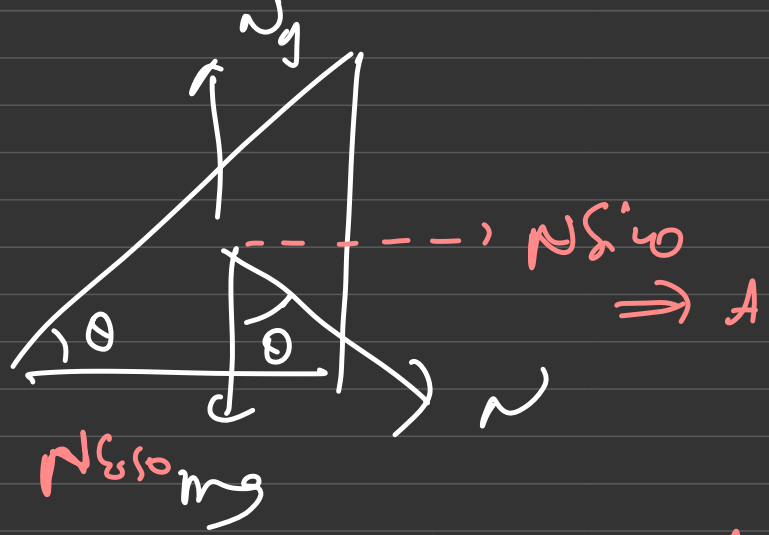


(3) axis

(4)

$$mg\sin\theta = m \times \{ a_r - A\cos\theta \} \quad -(1)$$

$mg\cos\theta - N = m\,a\sin\theta$ — (II)



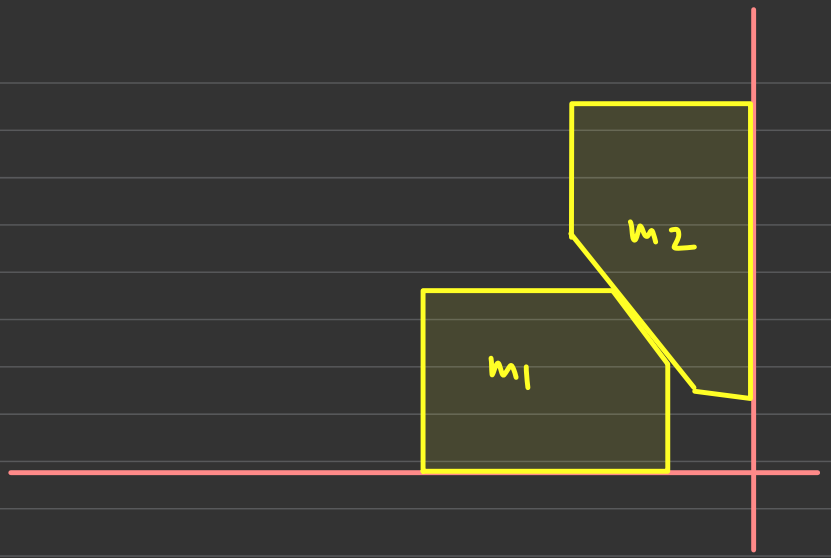
Solve equation H.W

$N\sin\theta = MA$ — (III)

$N_y = N\cos\theta + Mg$ — (IV)

Q

H.W



Smooth Surfaces

Pulley and forces

Prob

(1) find acc elevation of m_1 and m_2?

DTS#3 → Level 1
↳ Level 2

Module # 7.10

INE #3