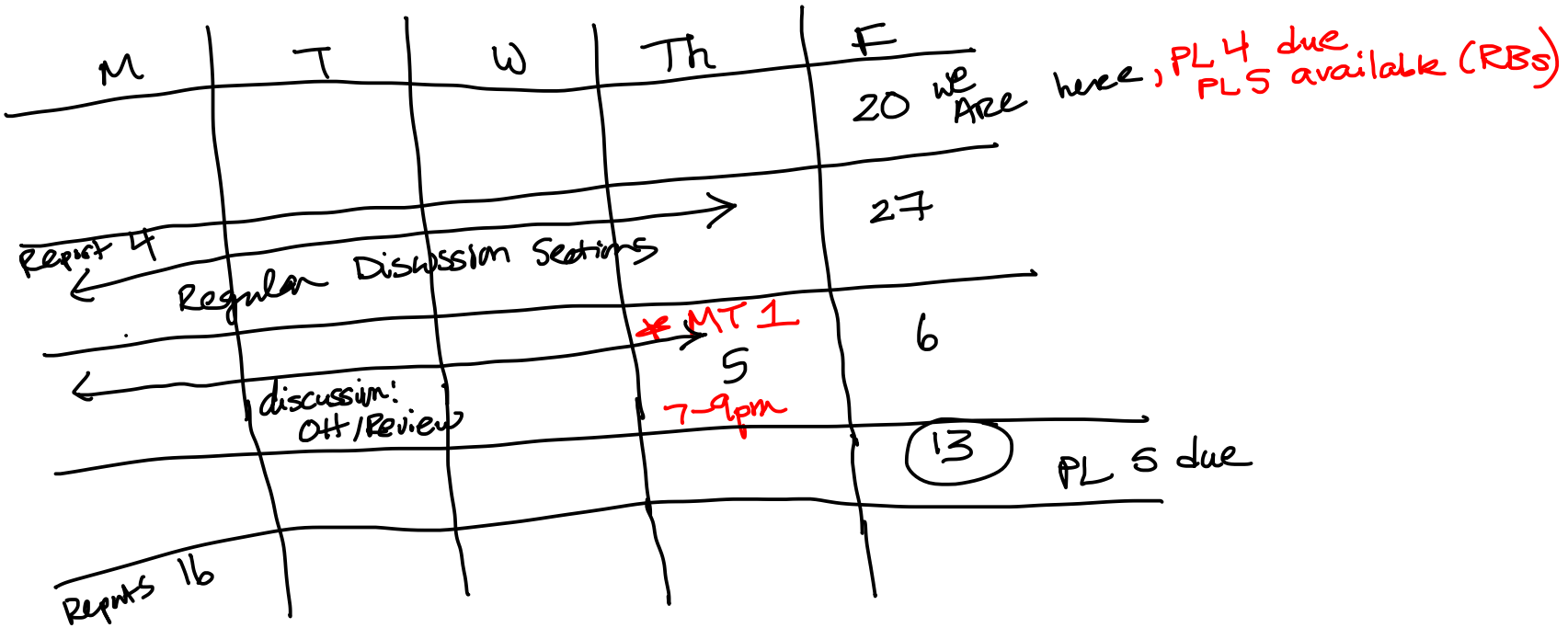
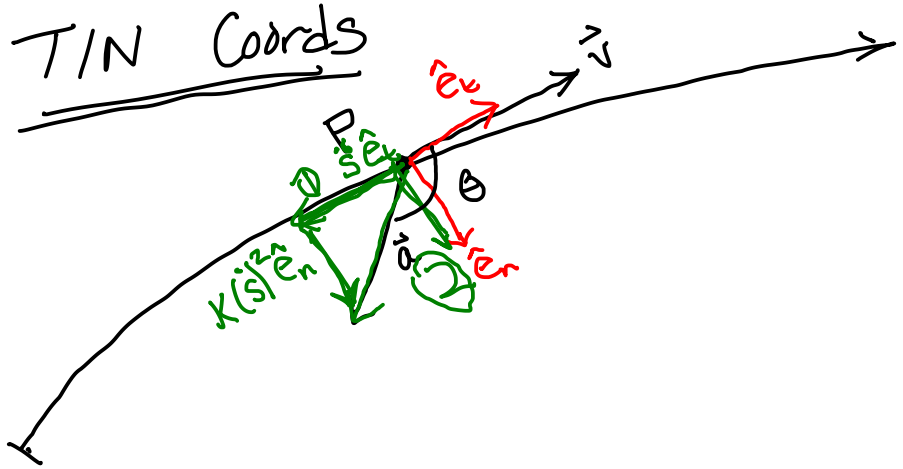
TAM 212: Class 14 - Rigid Bodies.



T/N Coords



$$\vec{v} = \dot{s}\,\hat{e}_t$$

$$\vec{a} = \ddot{s}\,\hat{e}_t + \kappa(\dot{s})^2\hat{e}_n$$

① change in speed

② change in direction of $\vec{v}$

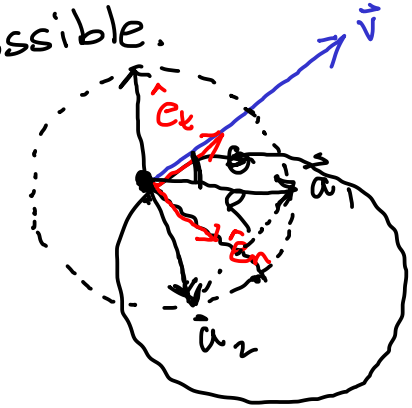
Ex) given : radius of curvature ρ, speed $v = \dot{s}$, magnitude of accel a

find : angle θ between $\vec{a}, \vec{v}$

A) I can do it

B) It can be done, but I don't know how

C) Not possible.



$$\vec{a} = a_t\,\hat{e}_t + a_n\,\hat{e}_n$$

$a_t = \ddot{s}$: $a_n = \kappa(\dot{s})^2$

$$a = \|\vec{a}\| = \left[(\ddot{s})^2 + \kappa^2(\dot{s})^4\right]^{1/2}$$

$$a = \sqrt{a_t^2 + a_n^2}$$

a_n is known

$\kappa = 1/\rho$

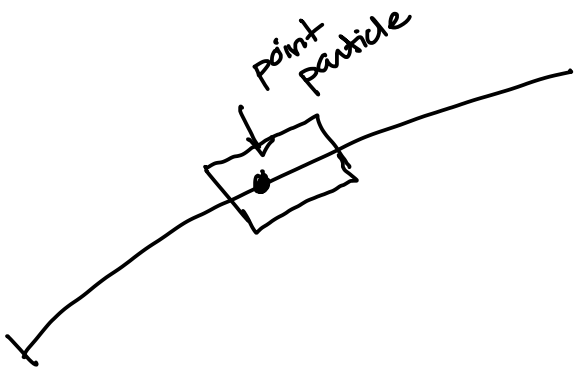
$\dot{s} = v$

Ex) A) TRUE
B) FALSE

$$\frac{d^2s}{dt^2} = \frac{d}{dt}\left\| \dot{\vec{r}} \right\|$$

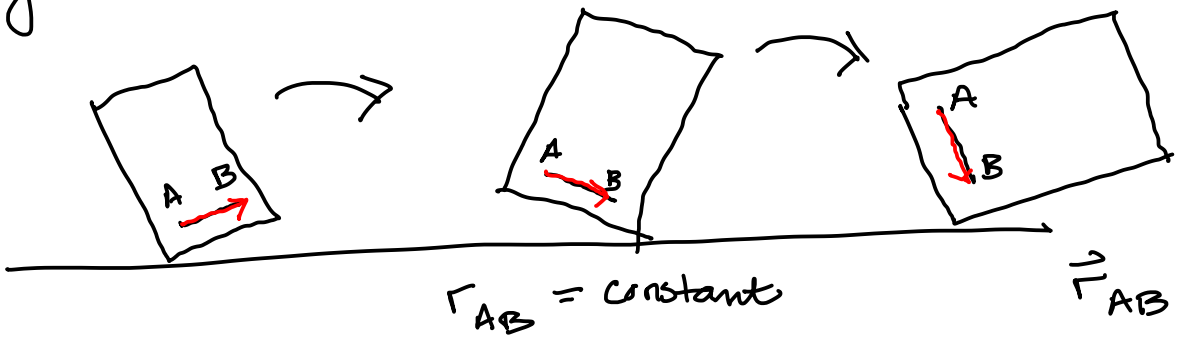
$$\dot{\vec{r}} = \vec{v} \Longrightarrow \frac{d^2s}{dt^2} = \frac{d}{dt}\left\| \vec{v} \right\|$$

$$\left\| \vec{v} \right\| = \dot{s} \Longrightarrow \frac{d^2s}{dt^2} = \frac{d}{dt}(\dot{s})$$



Rigid Bodies $\Rightarrow$ "non deformable"

* distance between any two points A, B stays the same during the motion

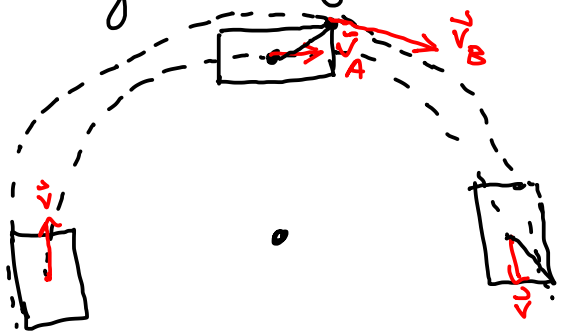


r_{AB} = constant

$\vec{r}_{AB}$ Not constant

Who cares? (significance)

The velocities of various points on a R.B. are related to each other by the angular velocity of the rigid body.



Given $\vec{v}_A$ and $\vec{\omega} = \omega\hat{k}$

We can always find the velocity of ANY OTHER POINT ON THE RIGID BODY