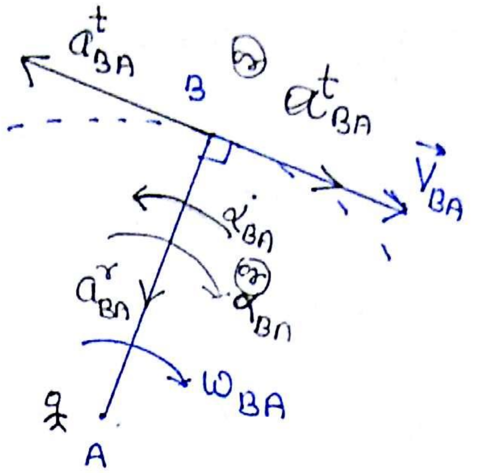
# Acceleration Analysis




$$\vec{a}_{BA} = \frac{d}{dt}\vec{V}_{BA}$$

Must be present

$$\boxed{a^r_{BA} = \frac{V_{BA}^2}{BA} = (BA)(\omega_{BA}^2)}$$

bcoz of the Change in Velocity $dir^n$

{dir (B → A)}

* In Circular motion this $acc^n \neq 0$
* this is know for every line
* $dir^n$ towards centre.

$$\boxed{a^t_{BA} = (BA)\,\alpha_{BA}}$$

bcoz of the change in Velocity magnitude

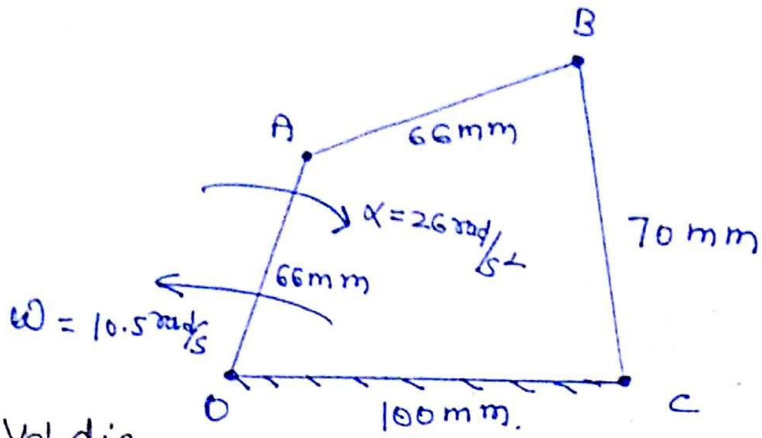
* only known for Input line.
* May or May not be zero.
* $Dir^n \perp$ to Radial.

$$a^r = r\omega^2$$

$$a^t = r\alpha$$

$$\alpha = \frac{d\omega}{dt}$$

Prob



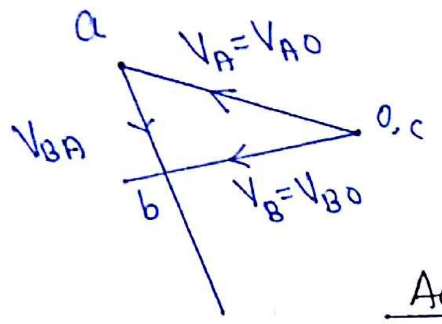

$a_B = ?$

$a_{BA} = ??$

$\alpha_{BA} = ??$

$\alpha_{BC} = ?$

Scale Vel dia

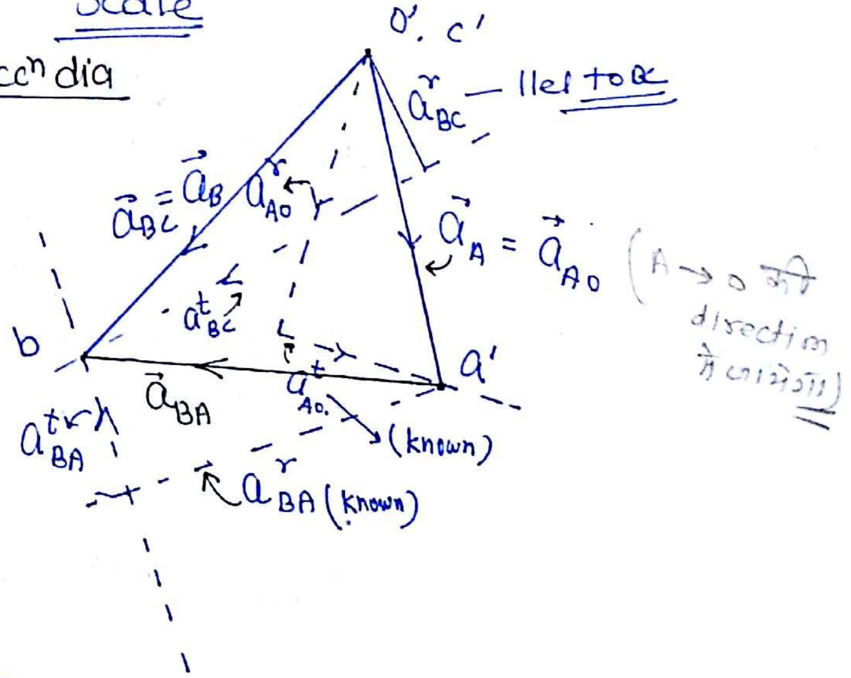



$V_{AO} = (0.066) \times 10.5$

$V_{AO} =$ m/s → scale and draw V-dig

Scale

Accⁿ dia




After Velocity dia

$a^r_{AO} = \dfrac{V_{AO}^2}{AO}$ ✓

$a^r_{BA} = \dfrac{V_{BA}^2}{BA}$ ✓

$a^r_{BC} = \dfrac{V_{BC}^2}{BC}$ ✓

$a^t_{AO} = (AO)\,\alpha_{AO}$ ← Given

↳ ⊥ to $a^r$

| Point | w.r.t. | Procedure |
|---|---|---|
| A | O | $a^r_{AO}$ → known; $a^t_{AO}$ → known. |
| B | A | $a^r_{BA}$ = known; $(BA)\,\alpha_{BA} = a^t_{BA}$ (unknown) ⊥ to radial |
| B | C | $a^r_{BC}$ = known; $(BC)(\alpha_{BC}) = a^t_{BC}$ (unknown) ⊥ to radial |

measure

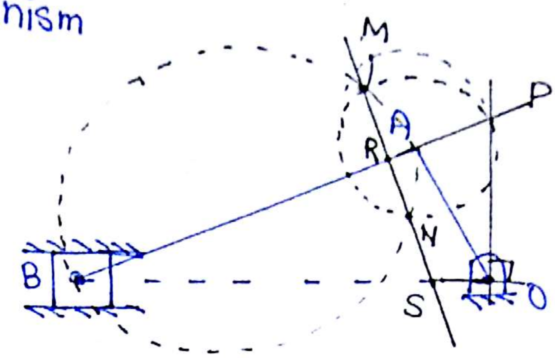
d-scale & find

$\alpha_{BC}$ & $\alpha_{BA}$

# Klein's Construction:-

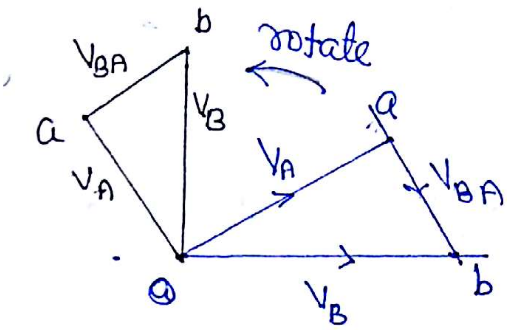
This Construction is only applied in Basic Single Slider crank Mechanism when $\alpha_{crank} = 0$

Given $\omega_{crank}$



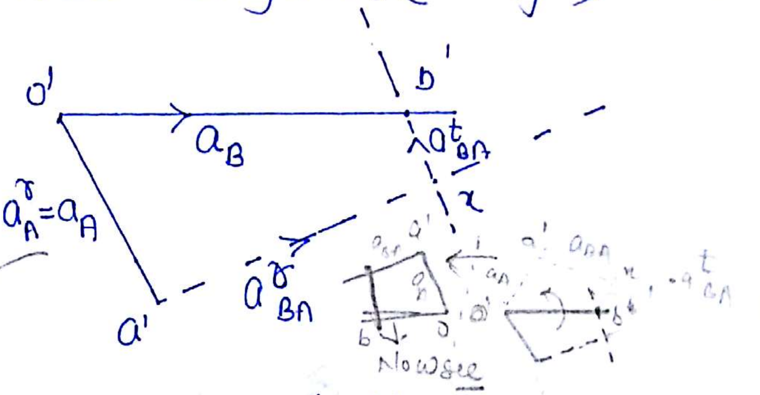

$\triangle OAP$ (Velocity $\triangle$)

Velocity Diagram (Rough)




$\diamond OARS$ (Acc$^n$ $\diamond$)

Acce$^n$ diagram (Rough)




Rotate about o'b' on mirror ~~img~~ Image

Compare both

$$\frac{V_A}{OA} = \frac{V_B}{OP} = \frac{V_{BA}}{AP} = \omega_{crank}$$

↓ Given.

Compare both.

$$\frac{a_A}{OA} = \frac{a^t_{BA}}{RS} = \frac{a_B}{OS} = \frac{a^r_{BA}}{AR} = \omega^2_{crank}$$

Note

① If point O and P coincide $\Rightarrow$ $OP = 0$

$V_B = 0$

Slider at extreme position

② If point O and S coincide $\Rightarrow$ $OS = 0$

$a_B = 0$

$V_B \rightarrow$ maximum

Slider at mid position

③ If point A and R Coincide $\Rightarrow$ $AR = 0$

$a^r_{BA} = 0$

$\Rightarrow$ (C.R.) – pure translation.

4. If point R & S coincide $\Rightarrow$ $RS = 0$

$a^t_{BA} = 0$

$\Rightarrow (BA)(\alpha_{BA}) = 0$

$\alpha_{BA} = 0$

$\omega_{BA} =$ Constant

Connecting Rod having Constant Angular Velocity.

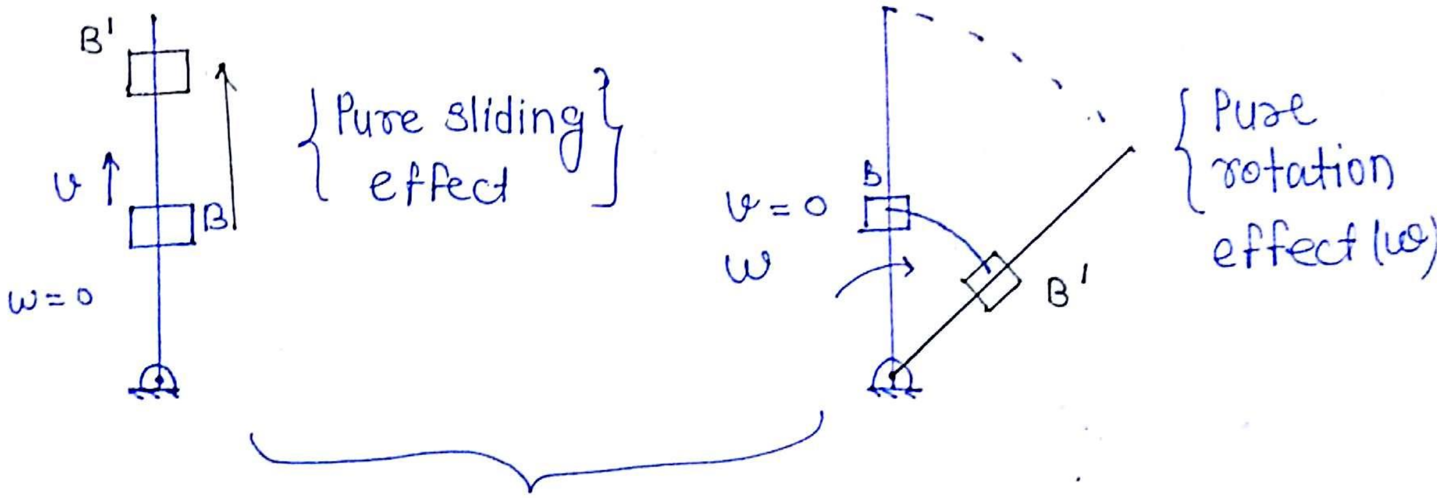
Coriolis Accen: ($a^c$)

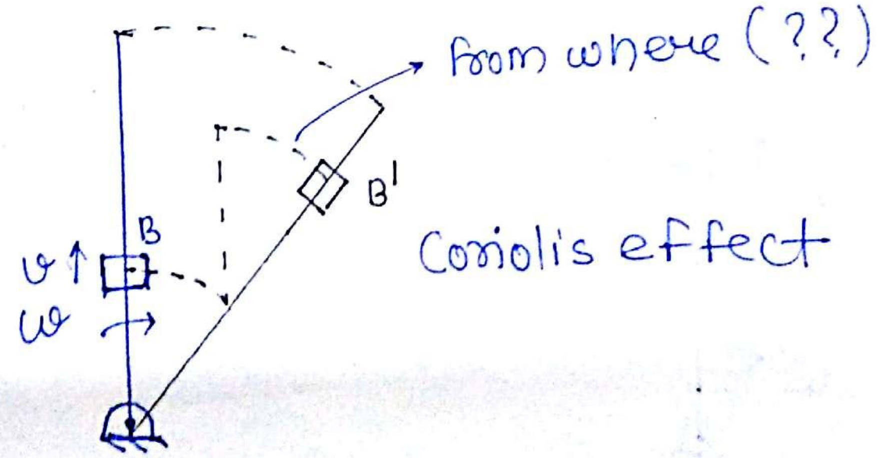
This accen will always be associated with the Slider, when the slider is sliding on the Rotating Body.

The magnitude will be :- $\boxed{a^c = 2v\omega}$

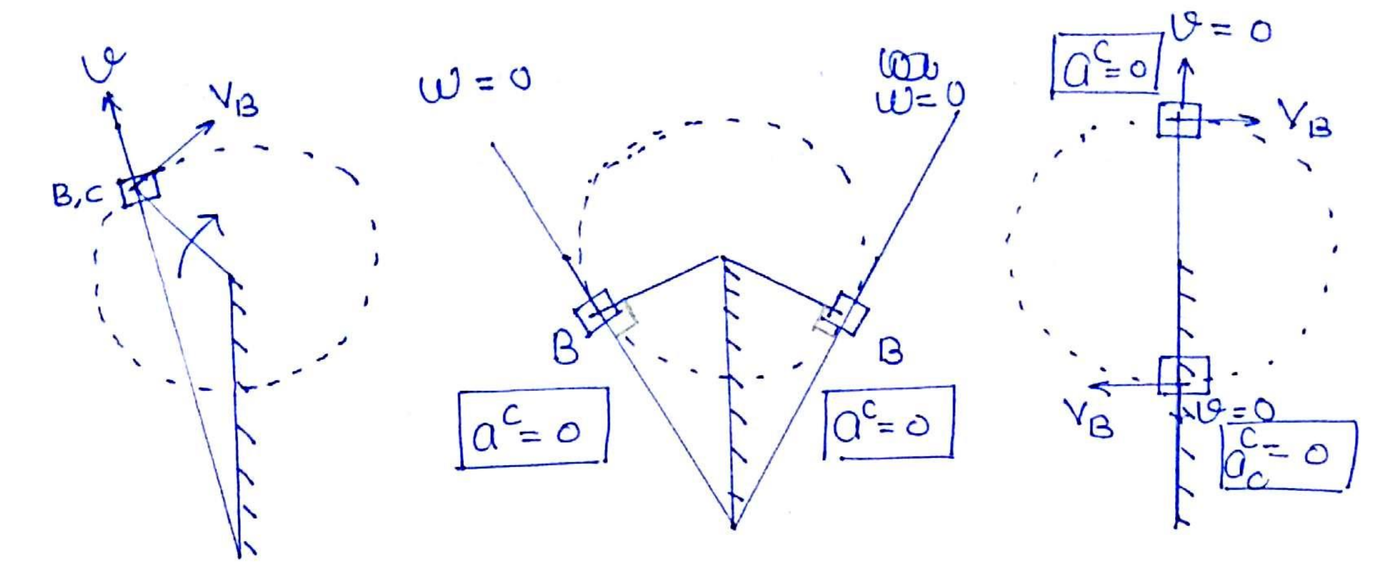
where $v$ - sliding velocity of slider

$\omega$ - Angular velocity of Body on which slider is sliding.



In crank slotted mechanism.



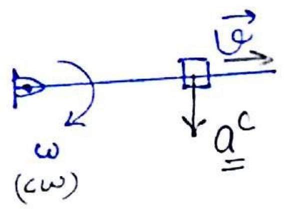

$a^c$ will exists

At 4 position from ∞ position $a^c$ will be zero.

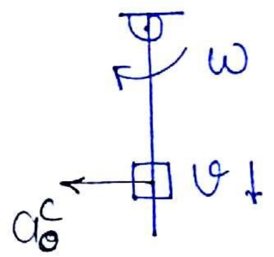
Direction of $a^c$ (i) Take the sense of ω

(ii) Rotate the $\vec{v}$ in that sense by 90°

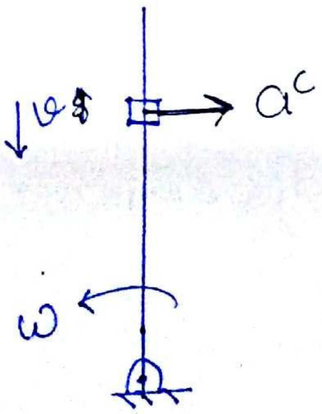
eg.




eg




eg



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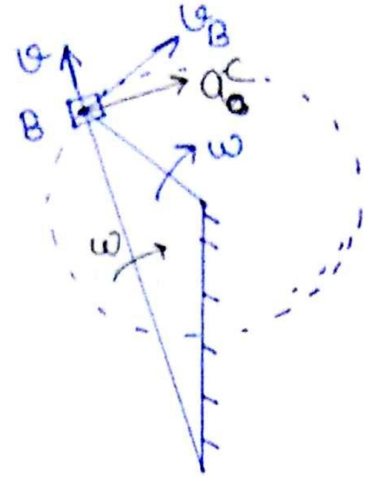
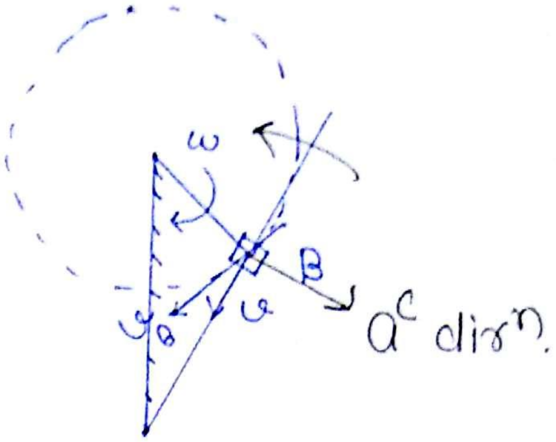
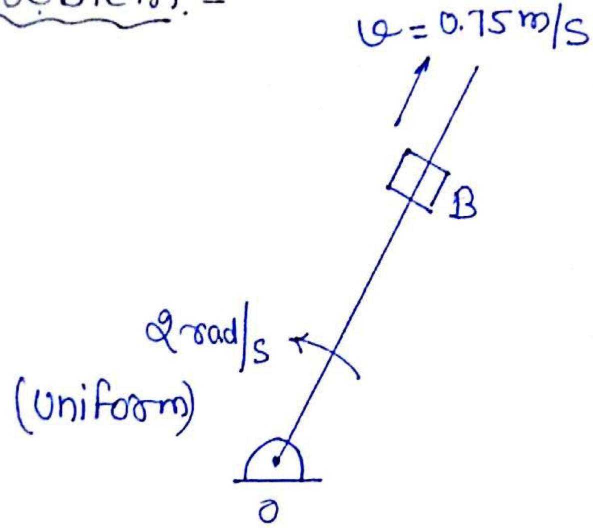
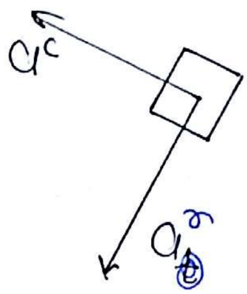



Problem:-

Find the acc$^n$ of Slider




$$a^c = 2v\omega = 2(0.75) \times 2 = 3 \text{ m/s}^2$$

$$a_B^r = r\omega^2 = (1)(2)^2 = 4 \text{ m/s}^2$$

$$a_{net} = \sqrt{3^2 + 4^2} = 5 \text{ m/s}^2$$