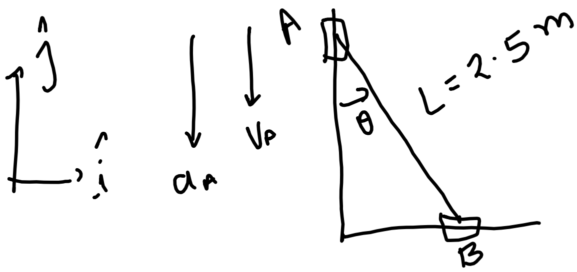


$\theta = 34^\circ$

$V_A = 3\ m/s$

$a_A = 8.7\ m/s$

$\alpha_{AB} = ?$

for planar case,
$\vec{\omega}\times(\vec{\omega}\times\vec{r}) = -|\vec{\omega}|^2\vec{r}$

$$\vec{a}_B = \vec{a}_A + \vec{a}_{B/A}$$
$$= \vec{a}_A + \vec{\alpha}_{AB}\times\vec{r}_{B/A} + \vec{\omega}_{AB}\times(\vec{\omega}_{AB}\times\vec{r}_{B/A})$$
$$=$$

$$\vec{V}_B = \vec{V}_A + \vec{V}_{B/A} = \vec{V}_A + \vec{\omega}_{AB}\times\vec{r}_{B/A}$$

$$\vec{V}_A = -V_A\,\hat{j}\ ,\quad \vec{\omega}_{AB} = \omega_{AB}\,\hat{k}$$
$$\vec{V}_B = V_B\,\hat{i}\ ,\quad \vec{r}_{B/A} = L\sin\theta\,\hat{i} - L\cos\theta\,\hat{j}$$

$$\vec{V}_B = \vec{V}_A + \vec{\omega}_{AB}\times\vec{r}_{B/A}$$
$$V_B\,\hat{i} = -V_A\,\hat{j} + \omega_{AB}\,\hat{k}\times(L\sin\theta\,\hat{i} - L\cos\theta\,\hat{j})$$
$$V_B\,\hat{i} = -V_A\,\hat{j} + \omega_{AB}L\sin\theta\,\hat{j} + \omega_{AB}L\cos\theta\,\hat{i}$$
$$V_B\,\hat{i} = \omega_{AB}L\cos\theta\,\hat{i} + (\omega_{AB}L\sin\theta - V_A)\,\hat{j}$$

As $V_{B,y} = 0$, $\omega_{AB}L\sin\theta - V_A = 0$

$$\Rightarrow \omega_{AB} = \frac{V_A}{L\sin\theta}$$

$$\vec{a}_B = a_B\,\hat{i}, \quad \vec{a}_A = -a_A\,\hat{j}$$
$$\vec{\alpha}_{AB} = \alpha_{AB}\,\hat{k}$$
$$\vec{\omega}_{AB} = \frac{V_A}{L\sin\theta}\,\hat{k}, \quad \vec{r}_{B/A} = L\sin\theta\,\hat{i} - L\cos\theta\,\hat{j}$$

$$\vec{a}_B = \vec{a}_A + \vec{a}_{B/A}$$
$$= \vec{a}_A + \vec{\alpha}_{AB}\times\vec{r}_{B/A} + \vec{\omega}_{AB}\times(\vec{\omega}_{AB}\times\vec{r}_{B/A})$$

As $\vec{\omega}_{AB} \perp \vec{r}_{B/A}$,

$$\vec{a}_B = \vec{a}_A + \vec{\alpha}_{AB}\times\vec{r}_{B/A} - |\vec{\omega}_{AB}|^2\,\vec{r}_{B/A}$$
$$a_B\,\hat{i} = -a_A\,\hat{j} + \alpha_{AB}\,\hat{k}\times(L\sin\theta\,\hat{i} - L\cos\theta\,\hat{j}) - \omega_{AB}^2\,(L\sin\theta\,\hat{i} - L\cos\theta\,\hat{j})$$

$$= -a_A\,\hat{j} + \alpha_{AB}L\sin\theta\,\hat{j} + \alpha_{AB}L\cos\theta\,\hat{i} - \omega_{AB}^2 L\sin\theta\,\hat{i} + \omega_{AB}^2 L\cos\theta\,\hat{j}$$

$$a_B\,\hat{i} = (\alpha_{AB}L\cos\theta - \omega_{AB}^2 L\sin\theta)\,\hat{i} + (\alpha_{AB}L\sin\theta + \omega_{AB}^2 L\cos\theta - a_A)\,\hat{j}$$

As $a_{B,y} = 0$,
$$\alpha_{AB}L\sin\theta + \omega_{AB}^2 L\cos\theta - a_A = 0$$

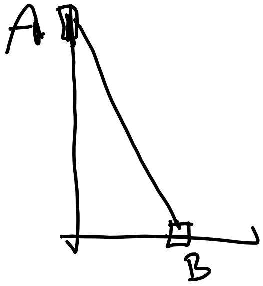
$$\omega_{AB} = \frac{V_A}{L\sin\theta}$$

$$\alpha_{AB}L\sin\theta + \frac{V_A^2}{L^2\sin^2\theta}L\cos\theta - a_A = 0$$

$$\Rightarrow \alpha_{AB} = \frac{a_A}{L\sin\theta} - \frac{V_A^2\cos\theta}{L^2\sin^3\theta}$$

$$= \frac{8.7}{2.5\times\sin(34)} - \frac{3^2\cos(34)}{2.5^2\times\sin^3(34)}$$

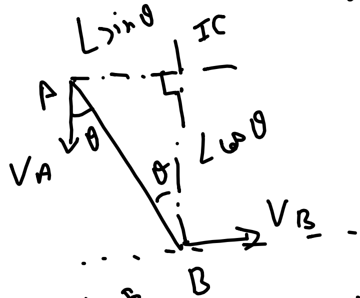
$$= -0.6041\ \text{rad/s}^2$$

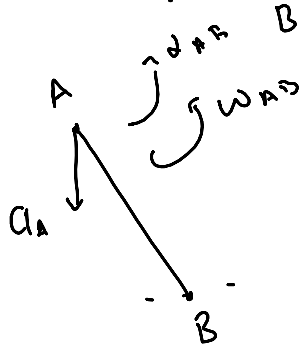


$\alpha_{AB} = ?$

$\omega_{AB} = ?$

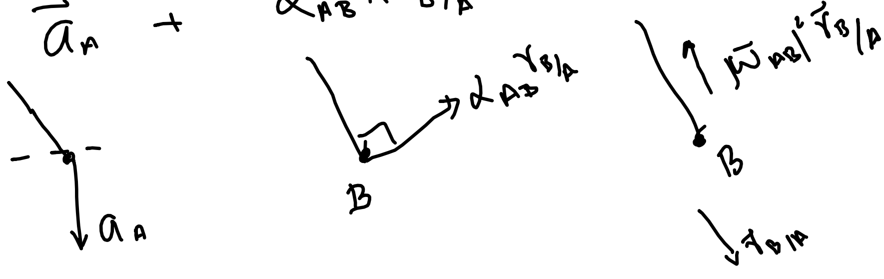
$$\omega_{AB} = \frac{V_A}{L\sin\theta} = \frac{V_B}{L\cos\theta}$$

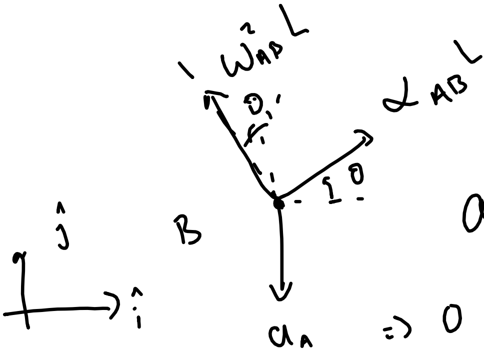




$$\vec{a}_B = \vec{a}_A + \vec{\alpha}_{AB} \times \vec{r}_{B/A} - |\bar{\omega}_{AB}|^2 \vec{r}_{B/A}$$

$$\vec{a}_B = \vec{a}_A + \vec{\alpha}_{AB} \times \vec{r}_{B/A} - |\bar{\omega}_{AB}|^2 \vec{r}_{B/A}$$





$a_{y,B} = 0$

$$\Rightarrow 0 = -a_A + \alpha_{AB} L \sin\theta + \omega_{AB}^2 L \cos\theta \quad //$$