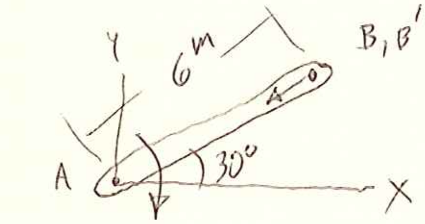
PROB. 15-160




$\vec{v}_{B/AB} = 0.2\ \frac{m}{s}$ $30°$, $\omega_{AB} = 0.08\ \frac{m}{s}$

FIND $v_B$ AND $a_B$

$$\vec{v}_B = \vec{v}_{B'} + \vec{v}_{B/AB}$$

$$\vec{v}_{B'} = \cancelto{0}{\vec{v}_A} + \omega_{AB}\hat{k} \times \vec{r}_{B'/A}$$

$$\vec{r}_{B'/A} = (6 \cdot \cos 30°)\hat{i} + (6 \cdot \sin 30°)\hat{j} = (5.196)\hat{i} + (3)\hat{j}\ m$$

$$\vec{v}_{B'} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & -0.08 \\ 5.196 & 3 & 0 \end{vmatrix}$$

$$= [0 - (-0.08)(3)]\hat{i} - [0 - (-0.08)(5.196)]\hat{j}$$

$$\vec{v}_{B'} = (0.24)\hat{i} + (-0.4157)\hat{j}\ \frac{m}{s}$$

$$\vec{v}_{B/AB} = (-0.2 \cdot \cos 30°)\hat{i} + (-0.2 \cdot \sin 30°)\hat{j}$$

$$\vec{v}_{B/AB} = (-0.1732)\hat{i} + (-0.1)\hat{j}\ \frac{m}{s}$$

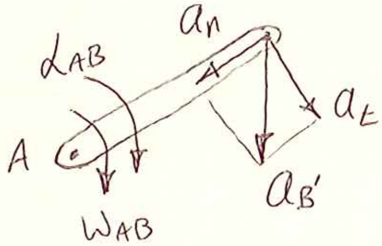
$$\vec{v}_B = (0.24)\hat{i} + (-0.4157)\hat{j} + (-0.1732)\hat{i} + (-0.1)\hat{j}$$

$$\vec{v}_B = (0.0668)\hat{i} + (-0.5157)\hat{j}\ \frac{m}{s},\ \theta = \tan^{-1}\left(\frac{0.5157}{0.0668}\right) = 82.62°$$

$$\boxed{\vec{v}_B = 0.520\ \frac{m}{s}\ \ 82.62°}$$

PROB. 15-160 CONT.

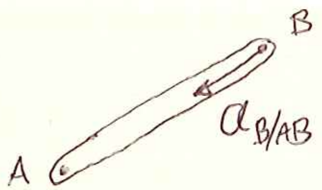
$$\vec{a}_B = \vec{a}_{B'} + \vec{a}_{B/AB} + \vec{a}_C$$



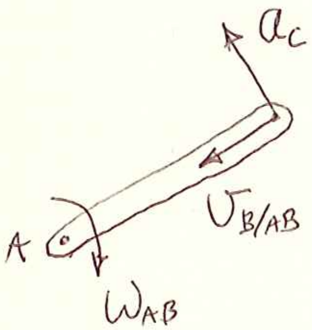

$$\vec{a}_{B'} = \cancelto{0}{\vec{a}_A} + \cancelto{0}{\alpha_{AB}}\hat{k} \times \vec{r}_{B'/A} - \omega_{AB}^2 \vec{r}_{B'/A}$$

$$\vec{a}_{B'} = -(-0.08)^2\left[(5.196)\hat{i} + (3)\hat{j}\right]$$

$$\vec{a}_{B'} = (-0.03325)\hat{i} + (-0.0192)\hat{j} \ \frac{m}{s^2}$$




$$\vec{a}_{B/AB} = 0$$




$$\vec{a}_C = 2\omega_{AB}\hat{k} \times \vec{v}_{B/AB} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & 2(-0.08) \\ -0.1732 & -0.1 & 0 \end{vmatrix}$$

$$\vec{a}_C = [0 - 2(-0.08)(-0.1)]\hat{i} - [0 - 2(-0.08)(-0.1732)]\hat{j}$$

$$\vec{a}_C = (-0.016)\hat{i} + (0.02771)\hat{j} \ \frac{m}{s^2}$$

$$\vec{a}_B = (-0.03325)\hat{i} + (-0.0192)\hat{j} + (-0.016)\hat{i} + (0.02771)\hat{j}$$

$$\vec{a}_B = (-0.04925)\hat{i} + (0.00851)\hat{j}, \quad \theta = \tan^{-1}\left(\frac{0.00851}{0.04925}\right) = 9.803^\circ$$

$$\boxed{\vec{a}_B = 0.04998 \ \frac{m}{s^2} \ \angle 9.803^\circ}$$

TOPS. 35500