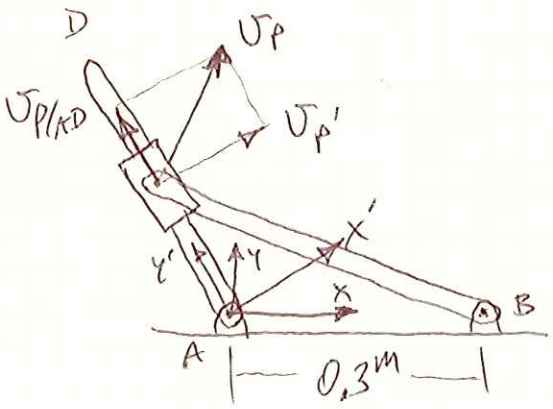
PROB. 15-151



$\omega_A = 10 \frac{RAD}{s}$ ↻, $\alpha_A = 0$

$A(0,0)^m$, $B(0.3,0)^m$

LAW OF SINES:

$$\frac{\sin 40^\circ}{0.3} = \frac{\sin 20^\circ}{L_{AP}}$$

$$L_{AP} = \left(\frac{\sin 20^\circ}{\sin 40^\circ}\right)(0.3) = 0.1596^m$$

$$x_P = -0.1596 \cdot \cos 60^\circ = -0.07981^m$$

$$y_P = 0.1596 \cdot \sin 60^\circ = 0.1382^m$$

$P(-0.07981, 0.1382)^m$

$$\vec{v}_P = \vec{v}_{P'} + \vec{v}_{P/AD}$$

$$\vec{v}_P = \cancel{\vec{v}_B}^{\,0} + \omega_B \hat{k} \times \vec{r}_{BP}$$

$$\vec{v}_P = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & \omega_B \\ -0.3798 & 0.1382 & 0 \end{vmatrix}$$

$$= [0 - (\omega_B)(0.1382)]\hat{i} - [0 - (\omega_B)(-0.3798)]\hat{j}$$

$$\vec{v}_P = (-0.1382\omega_B)\hat{i} + (-0.3798\omega_B)\hat{j} \ \frac{m}{s}$$

$$\vec{v}_{P'} = \omega_A \hat{k} \times \vec{r}_{AP}$$

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$$\vec{v}_{P'} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & -10 \\ -0.07981 & 0.1382 & 0 \end{vmatrix}$$

$$= [0 - (-10)(0.1382)]\hat{i} - [0 - (-10)(-0.07981)]\hat{j}$$

$$\vec{v}_{P'} = (1.382)\hat{i} + (0.7981)\hat{j} \ \frac{m}{s}$$

$$\vec{v}_{P/BE} = (-v_{P/AD} \cdot \cos 60^\circ)\hat{i} + (v_{P/AD} \cdot \sin 60^\circ)\hat{j}$$

$$\vec{v}_{P/BE} = (-0.5\, v_{P/AD})\hat{i} + (0.866\, v_{P/AD})\hat{j} \ \frac{m}{s}$$

$$\vec{v}_P = \vec{v}_{P'} + \vec{v}_{P/AD}$$

$$(-0.1382\, \omega_B)\hat{i} + (-0.3798\, \omega_B)\hat{j} = (1.382)\hat{i} + (0.7981)\hat{j} + (-0.5\, v_{P/AD})\hat{i} + (0.866\, v_{P/AD})\hat{j}$$

X-DIRECTION: $-0.1382\, \omega_B = 1.382 - 0.5\, v_{P/AD}$

$$\omega_B = -10 + 3.618\, v_{P/AD}$$

Y-DIRECTION: $-0.3798\, \omega_B = 0.7981 + 0.866\, v_{P/AD}$

$$-0.3798(-10 + 3.618\, v_{P/AD}) = 0.7981 + 0.866\, v_{P/AD}$$

$$3.798 - 1.374\, v_{P/AD} = 0.7981 + 0.866\, v_{P/AD}$$

$$\boxed{v_{P/AD} = 1.339 \ \frac{m}{s} \ \nwarrow 60^\circ}$$

PROB. 15-151 CONT.

$$\omega_B = -10 + 3.618(1.339)$$

$$\omega_B = -5.155 \ \frac{RAD}{S} \ \text{↓}$$