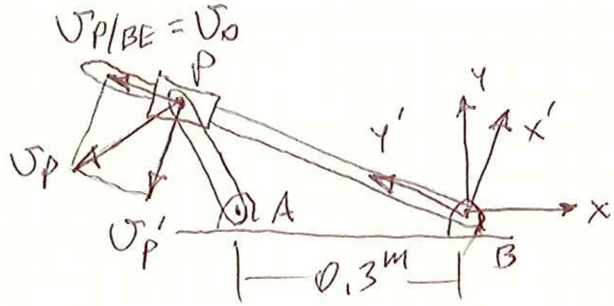
PROB. 15-152

$v_o = 0.48 \frac{m}{s}$ ↖ $20°$



FIND ω_A, ω_B

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

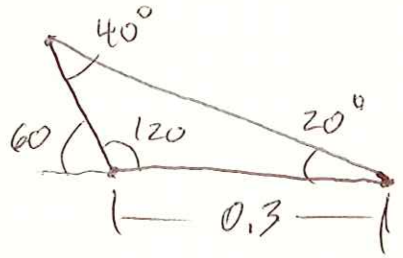
$\vec{v}_P = \vec{v}_{P}' + \vec{v}_o$

$\vec{v}_o = (-0.48 \cdot \cos 20°)\hat{i} + (0.48 \cdot \sin 20°)\hat{j}$

$\vec{v}_o = (-0.4510)\hat{i} + (0.1642)\hat{j} \ \frac{m}{s}$

$\vec{v}_P = \cancel{\vec{v}_A}^{\,0} + \omega_A \hat{k} \times \vec{r}_{AP}$

FIND POINT P: LAW OF SINES



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

$L_{AP} = \frac{(\sin 20°)}{(\sin 40°)} \cdot (0.3) = 0.1596^m$

$x_P = -0.3 - 0.1596 \cdot \cos 60° = -0.3798^m$

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

$P(-0.3798, 0.1382)^m$

$\vec{v}_P = \cancel{\vec{v}_A}^{\,0} + \omega_A \hat{k} \times \vec{r}_{AP}$

$\vec{r}_{AP} = [(-0.3798) - (-0.3)]\hat{i} + [(0.1382) - (0)]\hat{j}$

$\vec{r}_{AP} = (-0.07981)\hat{i} + (0.1382)\hat{j} \ ^m$

PROB. 15-152 CONT.

$$\vec{v}_P = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & \omega_A \\ -0.07981 & 0.1382 & 0 \end{vmatrix}$$

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

$$\vec{v}_P = (-0.1382\omega_A)\hat{i} + (-0.07981\omega_A)\hat{j} \ \tfrac{m}{s}$$

$$\vec{v}_{P'} = \omega_B \hat{k} \times \vec{r}_{PB}$$

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

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

$$\vec{v}_{P'} = (-0.1382\omega_B)\hat{i} + (-0.3798\omega_B)\hat{j} \ \tfrac{m}{s}$$

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

$$(-0.1382\omega_A)\hat{i} + (-0.07981\omega_A)\hat{j} = (-0.1382\omega_B)\hat{i}$$

$$+(-0.3798\omega_B)\hat{j} + (-0.451)\hat{i} + (0.1642)\hat{j}$$

X-DIRECTION: $-0.1382\omega_A = -0.1382\omega_B - 0.451$

$$\omega_A = \omega_B + 3.263$$

Y-DIRECTION: $-0.07981\omega_A = -0.3798\omega_B + 0.1642$

$$-0.07981(\omega_B + 3.263) = -0.3798\omega_B + 0.1642$$

PROB. 15-152 CONT.

$$-0.07981\,\omega_B - 0.2604 = -0.3798\,\omega_B + 0.1642$$

$$0.3\,\omega_B = 0.4246 \Rightarrow \boxed{\omega_B = 1.415 \ \tfrac{\text{RAD}}{\text{s}}}$$

$$\omega_A = (1.415) + 3.263 \ \boxed{= 4.678 \ \tfrac{\text{RAD}}{\text{s}}}$$