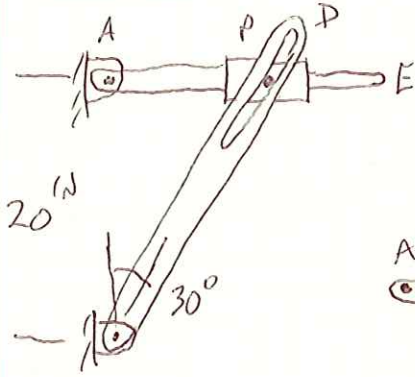
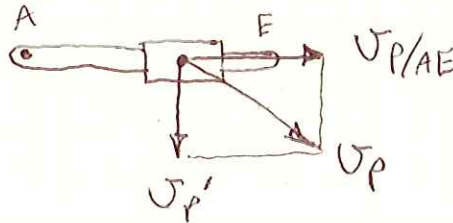


PROB. 15-154



$\omega_{AE} = 4 \frac{\text{RAD}}{\text{s}}$ \curvearrowright , $\omega_{BD} = 1.5 \frac{\text{RAD}}{\text{s}}$ \curvearrowright

FIND v_P



$\vec{v}_{P/AE} = (v_{PAE}) \hat{i}$

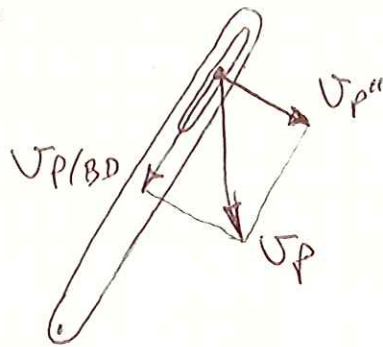
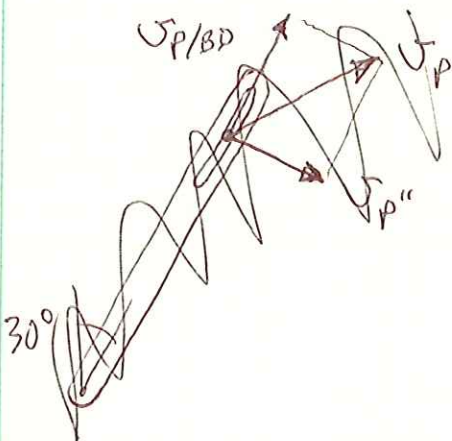
$\vec{v}_{P'} = \omega_{AE} \hat{k} \times \vec{r}_{AP}$

$L_{AP} = 20 \tan 30^\circ = 11.55 \text{ m}$

$\vec{v}_{P'} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & -4 \\ 11.55 & 0 & 0 \end{vmatrix} = -[0 - (-4)(11.55)] \hat{j}$

$\vec{v}_{P'} = (-46.19) \hat{j} \frac{\text{m}}{\text{s}}$

$\vec{v}_P = (v_{PAE}) \hat{i} + (-46.19) \hat{j} \frac{\text{m}}{\text{s}}$



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

$\vec{v}_{P''} = \omega_{BD} \hat{k} \times \vec{r}_{BD} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & -1.5 \\ 11.55 & 20 & 0 \end{vmatrix}$

PROB. 15-154 CONT.

$$\vec{U}_{P''} = [0 - (-1.5)(20)]\hat{i} - [0 - (-1.5)(11.55)]\hat{j}$$

$$\vec{U}_{P''} = (30)\hat{i} + (-17.32)\hat{j} \quad \frac{\text{N}}{\text{s}}$$

$$\vec{U}_{P/BD} = (-U_{PBD} \cdot \sin 30^\circ)\hat{i} + (-U_{PBD} \cdot \cos 30^\circ)\hat{j}$$

$$\vec{U}_{P/BD} = (-0.5 U_{PBD})\hat{i} + (-0.866 U_{PBD})\hat{j} \quad \frac{\text{N}}{\text{s}}$$

$$\vec{U}_P = (30)\hat{i} + (-17.32)\hat{j} + (-0.5 U_{PBD})\hat{i} + (-0.866 U_{PBD})\hat{j}$$

$$(U_{PAE})\hat{i} + (-46.19)\hat{j} = (30)\hat{i} + (-17.32)\hat{j} + (-0.5 U_{PBD})\hat{i}$$

$$+ (-0.866 U_{PBD})\hat{j}$$

$$X\text{-DIRECTION: } U_{PAE} = 30 - 0.5 U_{PBD}$$

$$Y\text{-DIRECTION: } -46.19 = -17.32 - 0.866 U_{PBD}$$

$$U_{PBD} = 33.34 \quad \frac{\text{N}}{\text{s}}$$

$$U_{PAE} = 30 - 0.5(33.34) = 13.33 \quad \frac{\text{N}}{\text{s}}$$

$$\vec{U}_P = (13.33)\hat{i} + (-46.19)\hat{j}, \quad \theta = \tan^{-1}\left(\frac{46.19}{13.33}\right) = 73.9^\circ$$

$$\vec{U}_P = 48.07 \quad \angle 73.9^\circ$$