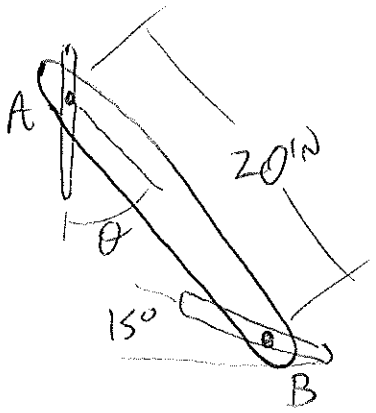
PROB. 15.39

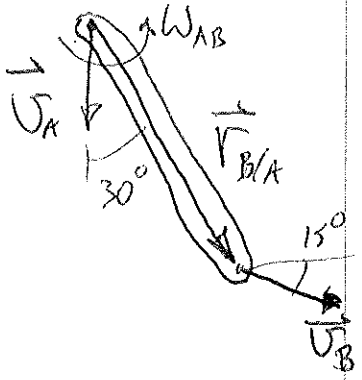


$\theta = 30°$, PIN A MOVES DOWN AT $v_A = 9 \frac{in}{sec}$

a) FIND ω_{AB}

$\vec{v}_B = \vec{v}_A + \vec{v}_{B/A} = \vec{v}_A + \omega\hat{k} \times \vec{r}_{B/A}$

$\vec{v}_A = (-9)\hat{j} \frac{in}{sec}$



$\vec{v}_B = (v_B \cos 15°)\hat{i} + (-v_B \sin 15°)\hat{j}$

$\vec{v}_B = (0.9659 v_B)\hat{i} + (-0.2588 v_B)\hat{j} \frac{in}{sec}$

FIND $\vec{r}_{B/A}$: $dx = 20 \cdot \sin 30° = 10 in$

$dy = -20 \cdot \cos 30° = -17.32 in$

$\vec{r}_{B/A} = (10)\hat{i} + (-17.32)\hat{j}$ in

$$\omega\hat{k} \times \vec{r}_{B/A} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & \omega \\ 10 & -17.32 & 0 \end{vmatrix}$$

$= [(0)(0) - (\omega)(-17.32)]\hat{i} - [(0)(0) - (\omega)(10)]\hat{j}$

$= (17.32\omega)\hat{i} + (10\omega)\hat{j}$

$\vec{v}_B = \vec{v}_A + \omega\hat{k} \times \vec{r}_{B/A}$

$(0.9659 v_B)\hat{i} + (-0.2588 v_B)\hat{j} = (-9)\hat{j} + (17.32\omega)\hat{i} + (10.0\omega)\hat{j}$

PROB. 15.39 CONT.

X-DIRECTION:

$0.9659\, v_B = 17.32\, w \Rightarrow v_B = 17.93\, w$

Y-DIRECTION:

$-0.2588\, v_B = -9 + 10\, w$

$-0.2588(17.93\, w) = -9 + 10\, w$

$(10 + 4.641)\, w = 9$

$w = 0.6147 \frac{\text{RAD}}{\text{SEC}}$ ↻

$v_B = 17.93(0.6147) = 11.02 \frac{\text{IN}}{\text{SEC}}$ → 15°