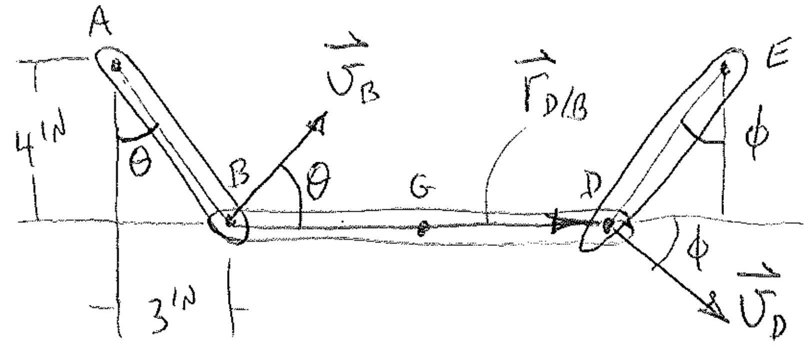
PROB. 15-68

$\omega_{AB} = 20 \frac{RAD}{SEC}$ CCW

a) FIND ω_{BDH}



$$\theta = TAN^{-1}\left(\frac{3}{4}\right) = 36.87°$$

$$\vec{v}_B = (v_B \cdot \cos 36.87)\hat{i} + (v_B \sin 36.87)\hat{j} = (0.8 v_B)\hat{i} + (0.6 v_B)\hat{j}$$

$$v_B = r_{AB}\omega_{AB}, \quad r_{AB} = \sqrt{3^2 + 4^2} = 5^{IN}$$

$$v_B = (5^{IN})\left(20 \frac{RAD}{SEC}\right) = 100 \frac{IN}{SEC}$$

$$\vec{v}_B = (80)\hat{i} + (60)\hat{j} \ \frac{IN}{SEC}$$

$$\phi = TAN^{-1}\left(\frac{3}{4}\right) = 36.87°$$

$$\vec{v}_D = (v_D \cos 36.87)\hat{i} + (-v_D \sin 36.87)\hat{j} = (0.8 v_D)\hat{i} + (-0.6 v_D)\hat{j}$$

$$\vec{v}_D = \vec{v}_B + \vec{v}_{D/B} = \vec{v}_B + (\omega_{BD})\hat{k} \times \vec{r}_{D/B}$$

$$(\omega_{BD})\hat{k} \times \vec{r}_{D/B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & \omega_{BD} \\ r_{DB} & 0 & 0 \end{vmatrix}$$

PROB. 15-68 CONT.

$$(\omega_{BD})\hat{k} \times \vec{r}_{D/B} = -[0-(\omega_{BD})(r_{BD})]\hat{j} = (r_{BD}\,\omega_{BD})\hat{j}$$

$$(0.8 v_D)\hat{i} + (-0.6 v_D)\hat{j} = (80)\hat{i} + (60)\hat{j} + (r_{BD}\,\omega_{BD})\hat{j}$$

X-DIRECTION:

$$0.8\, v_D = 80 \Rightarrow v_D = 100 \tfrac{\text{IN}}{\text{SEC}}$$

Y-DIRECTION:

$$(-0.6\, v_D) = 60 + r_{BD}\,\omega_{BD}$$

$$\omega_{BD} = \frac{-0.6(100) - 60}{(10^{\text{IN}})} \boxed{= -12.0 \tfrac{\text{RAD}}{\text{SEC}} \;↻}$$

b) FIND v_G

$$\vec{v}_G = \vec{v}_B + \vec{v}_{G/B} = \vec{v}_B + (\omega_{BG})\hat{k} \times \vec{r}_{G/B}$$

$$(\omega_{BG})\hat{k} \times \vec{r}_{G/B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & \omega_{BG} \\ r_{BG} & 0 & 0 \end{vmatrix}$$

$$= -[0-(\omega_{BG})(r_{BG})]\hat{j} = (r_{BG}\,\omega_{BG})\hat{j}$$

$$(v_{Gx})\hat{i} + (v_{Gy})\hat{j} = (80)\hat{i} + (60)\hat{j} + (r_{BG}\,\omega_{BG})\hat{j}$$

X-DIRECTION: $v_{Gx} = 80 \tfrac{\text{IN}}{\text{SEC}}$

Y-DIRECTION: $v_{Gy} = 60 + (5^{\text{IN}})(-12.0 \tfrac{\text{RAD}}{\text{SEC}}) = 0$

$$\boxed{v_G = 80 \tfrac{\text{IN}}{\text{SEC}} \rightarrow}$$