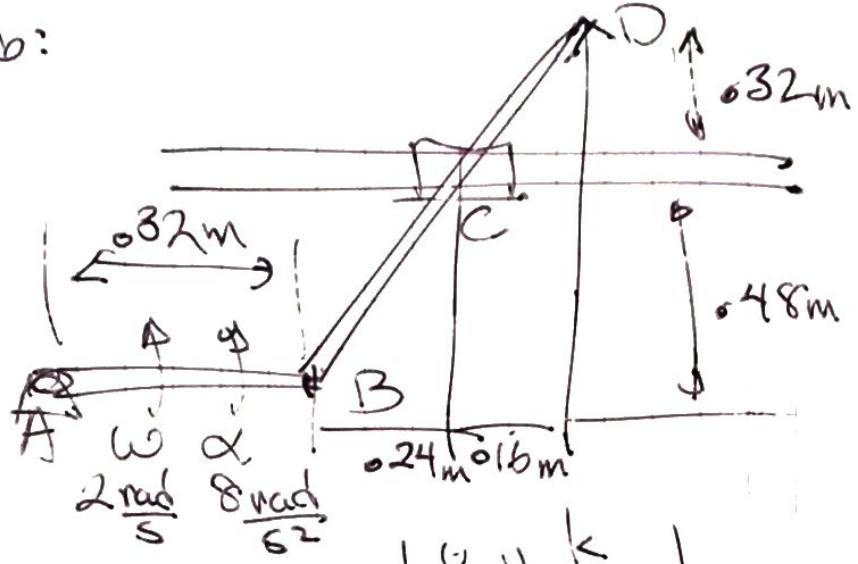
Sample Prob:



same long game as previous sample - whew!

Reqd ω_{BD}, α_{BD}

$$\bar{v}_{B/O} = \bar{v}_{A/O} + \bar{\omega} \times \bar{r}_{B/A} = \begin{vmatrix} i & j & k \\ 0 & 0 & \omega_{AB} \\ .32 & 0 & 0 \end{vmatrix} = .32\omega_{AB} = .64\hat{j}$$

$$\bar{a}_{B/O} = \bar{a}_{A/O} + \bar{\alpha}_{AB} \times \bar{r}_{B/A} - \omega_{AB}^2 (\bar{r}_{B/A})$$

$$\alpha \times r = \begin{vmatrix} i & j & k \\ 0 & 0 & \alpha_{AB} \\ .32 & 0 & 0 \end{vmatrix} = .32\alpha_{AB}\hat{j}$$

$$= 2.56\hat{j}$$

$$-\omega^2 r_{B/A} = -\omega^2 .32\hat{i} = -.13\hat{i}$$

$$\bar{a}_{B/O} = -.13\hat{i} + 2.56\hat{j}$$

1 SQUARE =

$$\bar{V}_{C/O} = \bar{V}_{B/O} + \bar{\omega}_{BCD} \times \bar{r}_{C/B} = .64\hat{j} + \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & \omega_{BCD} \\ .24 & .48 & 0 \end{vmatrix} \rightarrow -.48\omega_{BCD}\hat{i} + .24\omega_{BCD}\hat{j}$$

$$\bar{V}_{C/O} = -.48\omega_{BCD}\hat{i} + (.64 + .24\omega_{BCD})\hat{j}$$

but $\bar{V}_{C/O} = V_C\hat{i} \Rightarrow .64 + .24\omega_{BCD} = 0 \Rightarrow \omega_{BCD} = \frac{-.64}{.24}$

$$\omega_{BCD} = -2.67$$ (this is $\frac{1}{3}$ of what we got in HW 6 when $\omega = 6 \frac{rad}{s}$)

$$V_C\hat{i} = -.48\omega_{BCD} = -.48(-2.67) = 1.28 m/s$$

$$\bar{a}_{C/O} = \bar{a}_{B/O} + \bar{\alpha} \times \bar{r}_{C/B} - \omega^2 r_{C/B}$$

$$= (-.13\hat{i} + 2.56\hat{j}) + \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & \alpha_{BCD} \\ .24 & .48 & 0 \end{vmatrix} = -.48\alpha_{BCD}\hat{i} + .24\alpha_{BCD}\hat{j}$$

$$-\omega^2_{BCD}\bar{r}_{C/B} = -1.71\hat{i} - 3.42\hat{j}$$

$$a_{C/O} = (-.13\hat{i} + 2.56\hat{j}) + (-.48\alpha_{BCD}\hat{i} + .24\alpha_{BCD}\hat{j}) + (-1.71\hat{i} - 3.42\hat{j})$$

$$= (-.13 - .48\alpha_{BCD} - 1.71)\hat{i} + \underbrace{(2.56 + .24\alpha_{BCD} - 3.42)\hat{j}}_{=0}$$

$$\Rightarrow 2.56 + .24\alpha_{BCD} - 3.42 = 0$$

$$\alpha_{BCD} = \frac{3.42 - 2.56}{.24} = 3.58 \text{ rad/s}^2$$

$$\Rightarrow a_{C/O}\hat{i} = -.13 - .48(3.58 \tfrac{\text{rad}}{s^2}) - 1.71 = 3.58 \text{ m/s}^2\,\hat{i}$$

Finally...

$$\bar{a}_{D/O} = \bar{a}_{B/O} + \bar{\alpha}_{BCD} \times \bar{r}_{D/B} - \omega_{BCD}^2(\bar{r}_{D/B})$$

$$= (-.13\hat{i} + 2.56\hat{j}) + (2.86\hat{i} + 1.43\hat{j}) + (-2.85\hat{i} - 5.7\hat{j})$$

$$\bar{a}_{D/O} = (-.12\hat{i} - 1.71\hat{j}) \quad \text{whew!}$$

$$\alpha_{BCD} \times r_{D/B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & 3.56 \\ .4 & -.8 & 0 \end{vmatrix}$$

$$= 2.86\hat{i} + 1.43\hat{j}$$

$$-\omega^2 r_{D/B} = -7.12(.4\hat{i} - .8\hat{j})$$

$$= -2.85\hat{i} - 5.7\hat{j}$$