

PROB. 15-172

$$\omega = \left(20 \frac{\text{REV}}{\text{MIN}}\right) \left(\frac{\text{MIN}}{60 \text{ S}}\right) \left(\frac{2\pi}{\text{REV}}\right) = 2.094 \frac{\text{RAD}}{\text{S}}$$

$$r = 0.25 \text{ m} @ \theta = 0, \quad r = 0.5 @ \theta = 90^\circ$$

FIND a_p AT POINT B

FIRST FIND u : UNIFORM MOTION ALONG THE ROD

FOR CONSTANT VELOCITY, $x = x_0 + u \cdot t$ EQN. (11.5)

$$\text{OR } r = r_0 + u \cdot t \Rightarrow u = (r - r_0) / t$$

FIND t : FOR CONSTANT ANGULAR VELOCITY,

$$\theta = \theta_0 + \omega \cdot t \quad \text{EQN. (15.15)}$$

$$t = (\theta - \theta_0) / \omega = \left(\frac{\pi}{2} \text{ RAD}\right) / \left(2.094 \frac{\text{RAD}}{\text{S}}\right) = 0.75 \text{ s}$$

$$u = (0.5 - 0.25 \text{ m}) / (0.75 \text{ s}) = \frac{1}{3} \frac{\text{m}}{\text{s}}$$

$$\vec{a}_B = \vec{a}_{B'} + \vec{a}_{B/AB} + \vec{a}_c$$

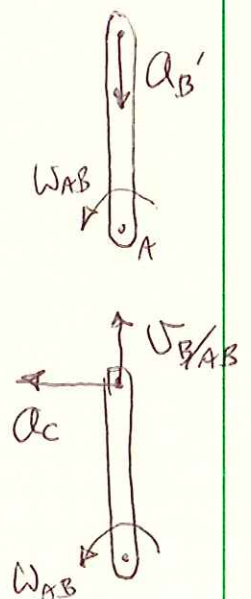
$$\vec{a}_{B'} = \cancel{\omega_{AB} \hat{k}} \times \vec{r}_{B/A} - \omega_{AB}^2 \vec{r}_{B/A} = -(2.094)^2 (0.5) \hat{j}$$

$$\vec{a}_{B'} = (-2.194) \hat{j} \frac{\text{m}}{\text{s}^2}$$

$$\vec{a}_{B/AB} = 0$$

$$\vec{a}_c = 2\omega_{AB} \hat{k} \times \vec{U}_{B/AB} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & 2(2.094) \\ 0 & \frac{1}{3} & 0 \end{vmatrix}$$

$$\vec{a}_c = [0 - 2(2.094)\left(\frac{1}{3}\right)] \hat{i} = (-1.396) \hat{i} \frac{\text{m}}{\text{s}^2}$$



PROB. 15-172 CONT.

$$\vec{a}_B = (-2.194)\hat{j} + (-1.396)\hat{i}$$

$$\theta = \text{TAN}^{-1}\left(\frac{2.194}{1.396}\right) = 57.53^\circ$$

$$\vec{a}_B = 2.60 \frac{\text{m}}{\text{s}^2} \nearrow 57.53^\circ$$