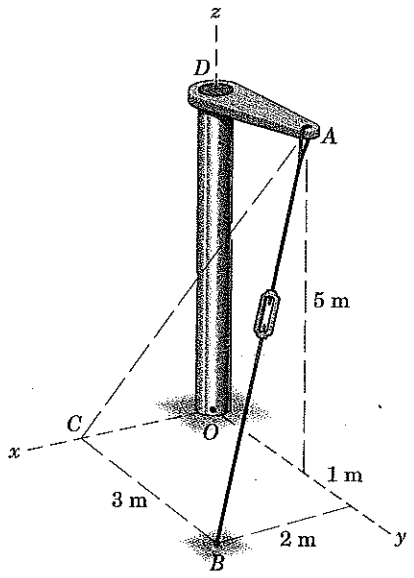
1



$$\bar{T} = T\,\bar{n}_{AB} = T\,\frac{\overline{AB}}{|\overline{AB}|}$$

$$\bar{T} = 2{,}4\,\frac{2\bar{i} + \bar{j} - 5\bar{k}}{\sqrt{2^2 + 1^2 + 5^2}}$$

$$\underline{\bar{T} = 0{,}876\,\bar{i} + 0{,}438\,\bar{j} - 2{,}19\,\bar{k} \ \ kN}$$

$$T_{AC} = \bar{T} \circ \bar{n}_{AC}$$

$$\bar{n}_{AC} = \frac{\overline{AC}}{|\overline{AC}|} = \frac{2\bar{i} - 2\bar{j} - 5\bar{k}}{\sqrt{2^2 + 2^2 + 5^2}}$$

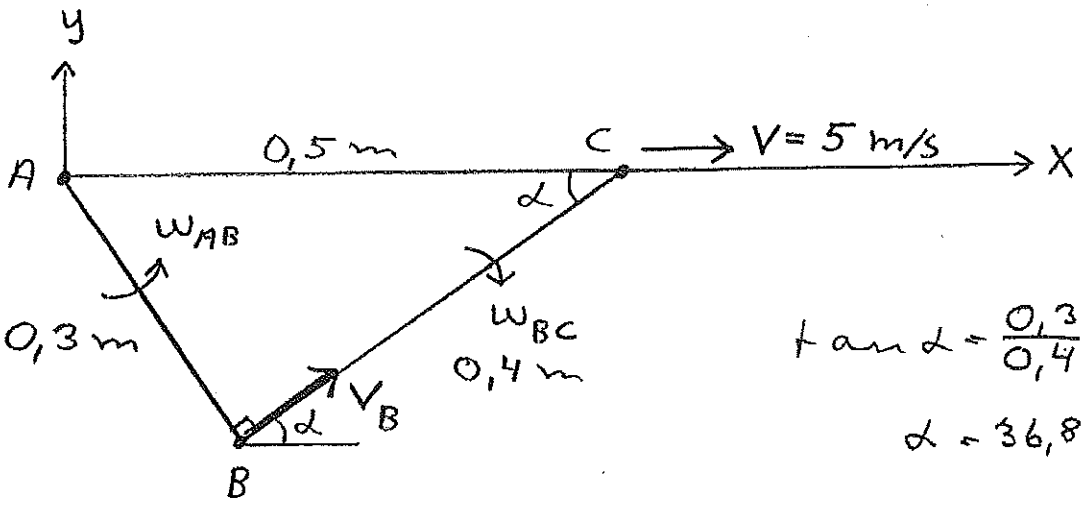
$$\bar{n}_{AC} = 0{,}348\,\bar{i} - 0{,}348\,\bar{j} - 0{,}870\,\bar{k}$$

$$T_{AC} = (0{,}876\,\bar{i} + 0{,}438\,\bar{j} - 2{,}19\,\bar{k}) \circ$$
$$\circ\,(0{,}348\,\bar{i} - 0{,}348\,\bar{j} - 0{,}870\,\bar{k})$$

$$T_{AC} = 0{,}305 - 0{,}152 + 1{,}905 \ kN$$

$$\underline{T_{AC} = 2{,}06 \ kN}$$

2



$\tan\alpha = \frac{0,3}{0,4}$

$\alpha = 36,87^\circ$

$$\overline{V_C} = \overline{V_B} + \overline{\omega_{BC}} \times \overline{BC}$$

$V_B = 0,3 \cdot \omega_{AB}$

$\overline{V_B} = 0,3\,\omega_{AB} \cos 36,87^\circ\, \bar{i} + 0,3\,\omega_{AB} \sin 36,87^\circ\, \bar{j}$

$\overline{V_B} = 0,3\,\omega_{AB} \cdot 0,8\,\bar{i} + 0,3\,\omega_{AB} \cdot 0,6\,\bar{j}$

$\overline{V_B} = 0,24\,\omega_{AB}\,\bar{i} + 0,18\,\omega_{AB}\,\bar{j}$

$$\begin{Bmatrix} 5 \\ 0 \\ 0 \end{Bmatrix} = \begin{Bmatrix} 0,24\omega_{AB} \\ 0,18\,\omega_{AB} \\ 0 \end{Bmatrix} + \boxed{\begin{Bmatrix} 0 \\ 0 \\ -\omega_{BC} \end{Bmatrix} \times \begin{Bmatrix} 0,32 \\ 0,24 \\ 0 \end{Bmatrix}} \quad \begin{Bmatrix} 0,24\,\omega_{BC} \\ -0,32\,\omega_{BC} \\ 0 \end{Bmatrix}$$

X-led ① $\quad 5 = 0,24\,\omega_{AB} + 0,24\,\omega_{BC}$

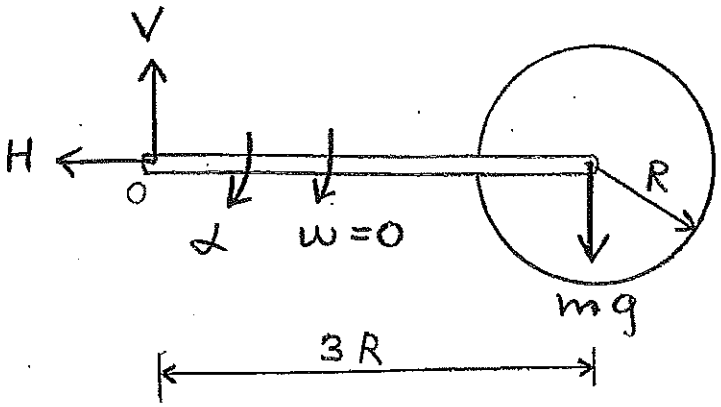
y-led ② $\quad 0 = 0,18\,\omega_{AB} - 0,32\,\omega_{BC}$

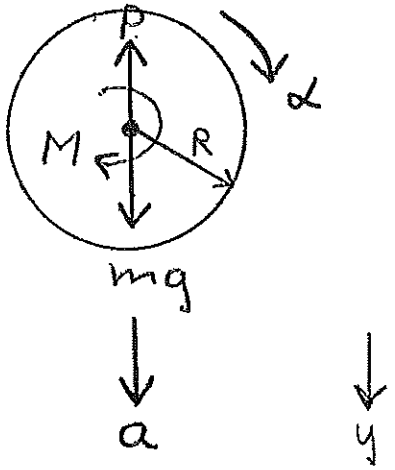
$\omega_{AB} = 13,33$ rad/s

$\omega_{BC} = 7,50$ rad/s

Svar: $\omega_{AB} = 13,3$ rad/s, $\omega_{BC} = 7,50$ rad/s

3





$$\Sigma M_0 = I_0 \cdot \alpha$$

$$mg \cdot 3R = I_0 \cdot \alpha$$

$$I_0 = I_G + m d^2 = \frac{1}{2} m R^2 + m(3R)^2 = \frac{19}{2} m R^2$$

$$mg \cdot 3R = \frac{19}{2} m R^2 \cdot \alpha$$

$$\alpha = \frac{6g}{19R}$$

Skivan

$$\Sigma F_y = m a_y$$

$$mg - P = ma \qquad a = 3R\alpha = 3R \cdot \frac{6g}{19R} = \frac{18}{19} g$$

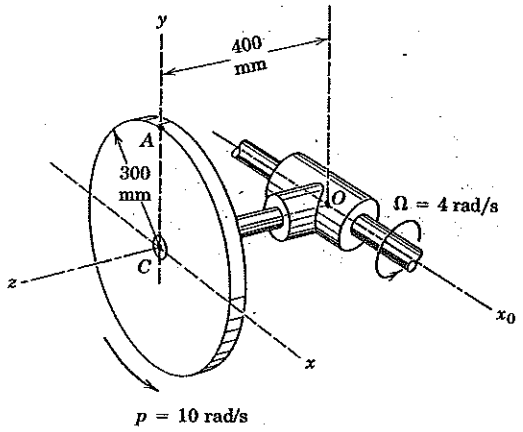
$$mg - P = m \cdot \frac{18}{19} g$$

$$P = mg - \frac{18}{19} mg$$

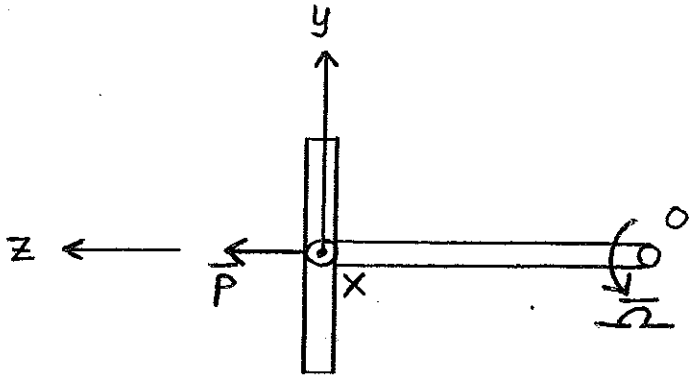
$$P = \frac{1}{19} mg$$

Svar: $\alpha = \frac{6g}{19R}$ $\quad P = \frac{1}{19} mg$

4



Problem 7/33



Givet: $p = 10$ rad/s
$\dot{p} = 6$ rad/s
$\Omega = 4$ rad/s

Sökes: α

$\bar{\Omega}$ mäter xyz. Skivan roterar i xyz.

$$\bar{\omega} = \bar{p} + \bar{\Omega} = \begin{Bmatrix} 0 \\ 0 \\ p \end{Bmatrix} + \begin{Bmatrix} \Omega \\ 0 \\ 0 \end{Bmatrix} = \begin{Bmatrix} \Omega \\ 0 \\ p \end{Bmatrix}$$

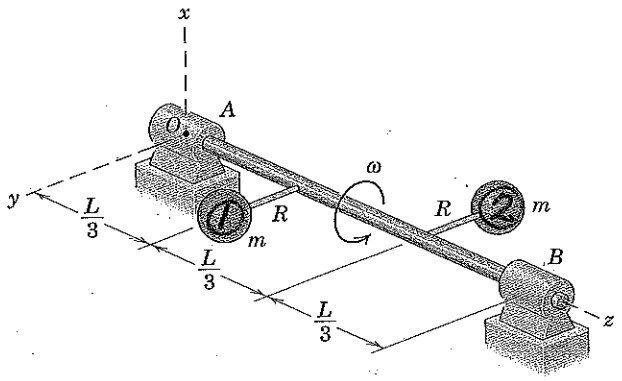
$$\bar{\alpha} = \left(\frac{d\bar{\omega}}{dt}\right)_{XYZ} = \left(\frac{d\bar{\omega}}{dt}\right)_{xyz} + \bar{\Omega} \times \bar{\omega}$$

$$\bar{\alpha} = \frac{d}{dt}\begin{Bmatrix} \Omega \\ 0 \\ p \end{Bmatrix} + \begin{Bmatrix} \Omega \\ 0 \\ 0 \end{Bmatrix} \times \begin{Bmatrix} \Omega \\ 0 \\ p \end{Bmatrix}$$

$$\bar{\alpha} = \begin{Bmatrix} 0 \\ 0 \\ \dot{p} \end{Bmatrix} + \begin{Bmatrix} 0 \\ -\Omega p \\ 0 \end{Bmatrix} = \begin{Bmatrix} 0 \\ -\Omega p \\ \dot{p} \end{Bmatrix} = \begin{Bmatrix} 0 \\ -40 \\ 6 \end{Bmatrix}$$

$$\bar{\alpha} = \begin{Bmatrix} 0 \\ -40 \\ 6 \end{Bmatrix} \text{ rad/s}^2$$

5



$$\bar{H}_o = \bar{I}_o \bar{\omega} \qquad \bar{\omega} = \begin{Bmatrix} 0 \\ 0 \\ \omega \end{Bmatrix}$$

$$\bar{H}_o = \begin{bmatrix} - & - & -I_{xz} \\ - & - & -I_{yz} \\ - & - & I_{zz} \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ \omega \end{bmatrix}$$

yz-planet är symmetriplan $\perp$ X-axeln $\Rightarrow$

$\Rightarrow I_{xz} = 0$

$$I_{yz} = I_{yzG} + m\, d_y\, d_z + I_{yzG} + m\, d_y\, d_z$$

(1) (2)

$$I_{yz} = \underset{\uparrow}{0} + m R \cdot \frac{L}{3} + \underset{\uparrow}{0} + m \cdot (-R) \cdot \frac{2L}{3} = -\frac{mRL}{3}$$

0 pga att xz-planet är symmetriplan för varje kula.

$$I_{zz} = mR^2 + mR^2 = 2mR^2$$

$$\bar{H}_o = \begin{bmatrix} - & - & 0 \\ - & - & mRL/3 \\ - & - & 2mR^2 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ \omega \end{bmatrix} = \begin{Bmatrix} 0 \\ \frac{mRL\omega}{3} \\ 2mR^2\omega \end{Bmatrix}$$

$$\underline{\bar{H}_o = mR\omega \left(\frac{L}{3} \bar{j} + 2R\bar{k} \right) \ \text{kg m}^2/\text{s}}$$

$$T = \frac{1}{2} \bar{\omega} \circ \bar{H}_o = \frac{1}{2} \begin{Bmatrix} 0 \\ 0 \\ \omega \end{Bmatrix} \circ \begin{Bmatrix} 0 \\ \frac{mRL\omega}{3} \\ 2mR^2\omega \end{Bmatrix}$$

$$\underline{T = mR^2\omega^2}$$