

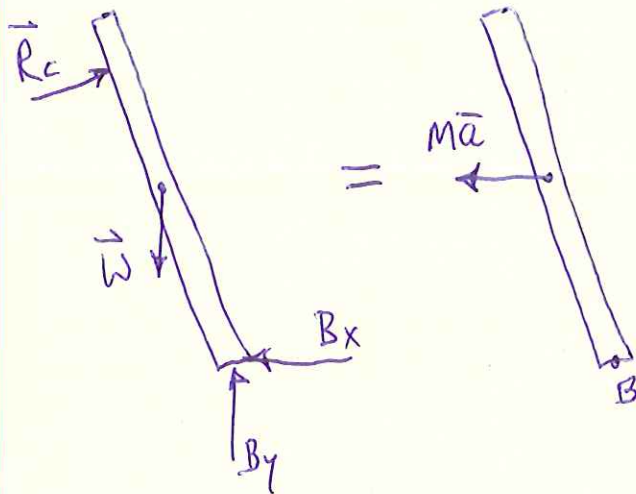
PROB. 16-1

$$M = 2.5 \text{ kg}, \quad \vec{a} = (-1.5) \hat{i} \frac{\text{m}}{\text{s}^2}$$

FIND R_C , R_B

BODY IN TRANSLATION

$$\begin{aligned} \vec{W} &= (-mg) \hat{j} \\ &= -(2.5 \text{ kg}) \left(9.81 \frac{\text{m}}{\text{s}^2} \right) \hat{j} \\ &= (-24.52) \hat{j} \text{ N} \end{aligned}$$



$$\begin{aligned} \vec{R}_C &= (R_C \cdot \cos 20^\circ) \hat{i} \\ &\quad + (R_C \cdot \sin 20^\circ) \hat{j} \\ \vec{R}_C &= (0.9397 R_C) \hat{i} \\ &\quad + (0.342 R_C) \hat{j} \end{aligned}$$

$$\Sigma F_x = M \bar{a}_x : 0.9397 R_C - B_x = M a_x = (2.5 \text{ kg}) \left(-1.5 \frac{\text{m}}{\text{s}^2} \right)$$

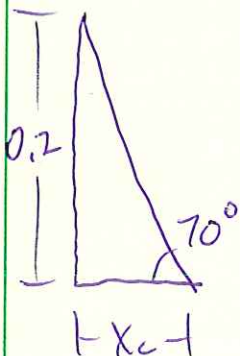
$$0.9397 R_C - B_x = -3.75$$

$$\Sigma F_y = M \bar{a}_y : -mg + B_y + 0.342 R_C = 0$$

$$0.342 R_C + B_y = (2.5 \text{ kg}) \left(9.81 \frac{\text{m}}{\text{s}^2} \right)$$

$$0.342 R_C + B_y = 24.52$$

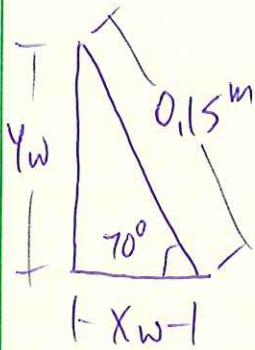
$$\Sigma \vec{M}_B = \Sigma (\vec{M}_B)_{\text{EFF}} : \text{FIND POSITION VECTORS FROM B}$$



$$\tan 70^\circ = \frac{0.2}{x_c}, \quad x_c = \frac{0.2}{\tan 70^\circ} = 0.07279 \text{ m}$$

$$\vec{r}_C = (-0.07279) \hat{i} + (0.2) \hat{j} \text{ m}$$

PROB. 16-1 CONT.



$$\cos 70^\circ = \frac{X_w}{0.15}, \quad X_w = 0.15 \cdot \cos 70^\circ = 0.0513 \text{ m}$$

$$\sin 70^\circ = \frac{Y_w}{0.15}, \quad Y_w = 0.15 \cdot \sin 70^\circ = 0.1409 \text{ m}$$

$$\vec{r}_w = (-0.0513) \hat{i} + (0.1409) \hat{j} \text{ m}$$

$$\vec{r}_c \times \vec{R}_c = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -0.07279 & 0.2 & 0 \\ 0.9397 R_c & 0.342 R_c & 0 \end{vmatrix}$$

$$= [(-0.07279)(0.342 R_c) - (0.2)(0.9397 R_c)] \hat{k}$$

$$= (-0.2128 R_c) \hat{k} \text{ N}\cdot\text{m}$$

$$\vec{r}_w \times \vec{w} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -0.0513 & 0.1409 & 0 \\ 0 & -24.52 & 0 \end{vmatrix}$$

$$= [(-0.0513)(-24.52)] \hat{k} = (1.258) \hat{k} \text{ N}\cdot\text{m}$$

$$\vec{r}_w \times M \vec{a}_x = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -0.0513 & 0.1409 & 0 \\ -3.75 & 0 & 0 \end{vmatrix}$$

$$= [0 - (0.1409)(-3.75)] \hat{k} = (0.5284) \hat{k} \text{ N}\cdot\text{m}$$

PROB. 16-1 CONT.

$$\sum \vec{M}_B = \sum (\vec{M}_B)_{\text{EFF}} :$$

$$-0.2128 R_C + 1.258 = 0.5284$$

$$\boxed{\vec{R}_C = 3.429 \text{ N} \nearrow 20^\circ}$$

$$0.9397(3.429) - B_x = -3.75 \Rightarrow B_x = 6.972 \text{ N}$$

$$0.342(3.429) + B_y = 24.52 \Rightarrow B_y = 23.35 \text{ N}$$

$$\vec{R}_B = (-6.972)\hat{i} + (23.35)\hat{j}, \quad \theta = \text{TAN}^{-1}\left(\frac{23.35}{6.972}\right) = 73.37^\circ$$

$$\boxed{\vec{R}_B = 24.37 \text{ N} \nearrow 73.37^\circ}$$