MILANO

MECH 234 + 235

PROB. 3-97

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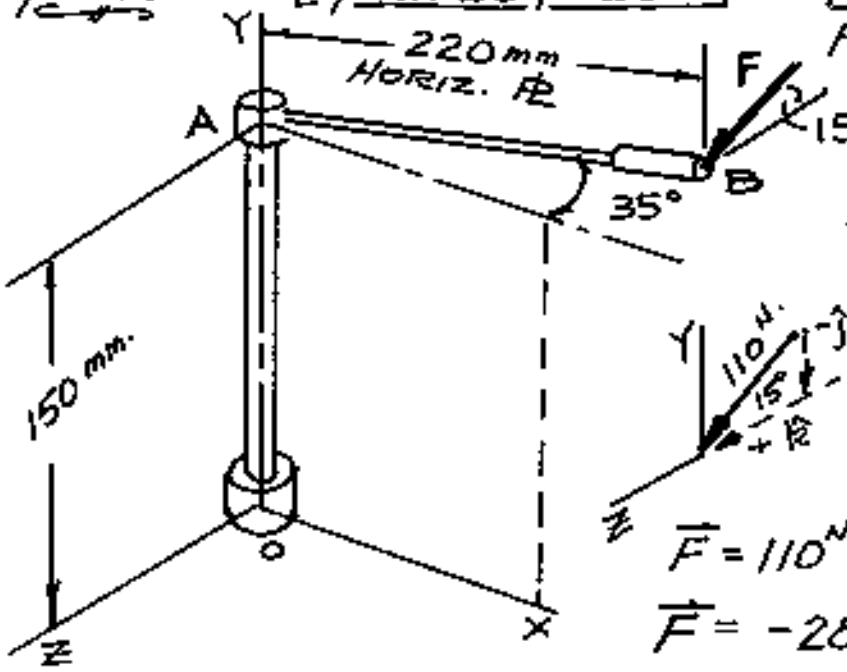


APPLIED FORCE

$F = 110^{N.}$

IN Y-Z PL




$\vec{F} = 110^{N.}\left[\sin 15°(-\hat{j}) + \cos 15°\,\hat{k}\right]$

$\vec{F} = -28.47\,\hat{j} + 106.25\,\hat{k}$

moment arm, $\vec{r}_{AB} = 220\text{ mm}\left[\cos 35°\,\hat{\imath} - \sin 35°\,\hat{k}\right]$


$\vec{r}_{AB} = 180.21\,\hat{\imath} - 126.19\,\hat{k}$

$$\vec{M}_A = \begin{vmatrix} \hat{\imath} & \hat{j} & \hat{k} \\ 180.2 & 0 & -126.2 \\ 0 & -28.5 & 106.3 \end{vmatrix} = \hat{\imath}\left[0 - (-126.2)(-28.5)\right] - \hat{j}\left[(180.2)(106.3) - 0\right] + \hat{k}\left[(180.2)(-28.5) - 0\right]$$

$\vec{M}_A = -3{,}596.7\,\hat{\imath} - 19{,}155.3\,\hat{j} - 5{,}135.7\,\hat{k}$ N-mm.

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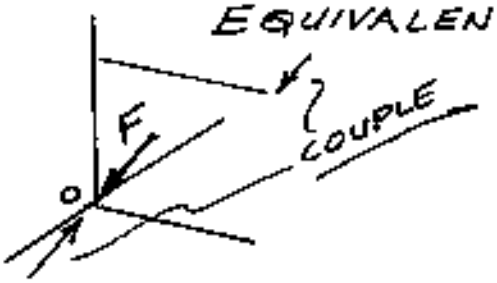
**BUT**, the moment about the origin requires $\vec{r}_{OB}$

$\therefore \vec{r}_{OB} = 180.2\,\hat{\imath} + 150\,\hat{j} - 126.2\,\hat{k}$

$$\vec{M}_O = \begin{vmatrix} \hat{\imath} & \hat{j} & \hat{k} \\ 180.2 & 150 & -126.2 \\ 0 & -28.5 & 106.3 \end{vmatrix} = \hat{\imath}\left[(150)(106.3) - (-126.2)(-28.5)\right] - \hat{j}\left[(180.2)(106.3) - 0\right] + \hat{k}\left[(180.2)(-28.5) - 0\right]$$

$\vec{M}_O = 12{,}348.3\,\hat{\imath} - 19{,}155.3\,\hat{j} - 5{,}135.7\,\hat{k}$ N-mm.

EQUIVALENT FORCE - COUPLE SYS.




$\vec{M}_O = 12.3\,\hat{\imath} - 19.2\,\hat{j} - 5.1\,\hat{k}$ N-m.

$\vec{F} = -28.5\,\hat{j} + 106.3\,\hat{k}$ N.