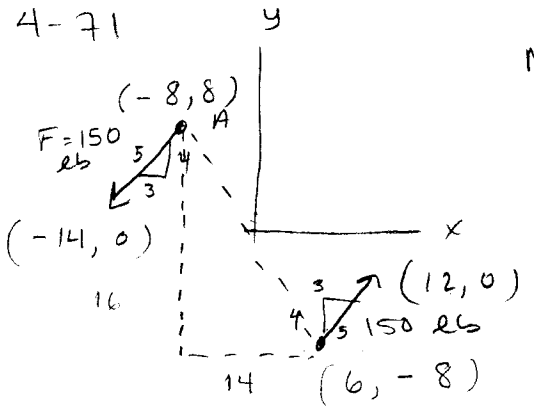
4-71



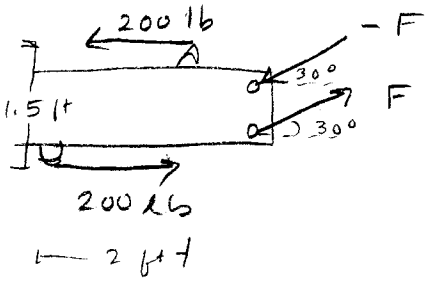
$$M_B = \sqrt{16^2 + 14^2}\,(150\ \text{lb}) = \boxed{3189\ \text{lb}\cdot\text{ft}}$$

or

$$M_B = 14\left(\tfrac{4}{5}\,150\right) + 16\left(\tfrac{3}{5}\,150\right)$$

$$= 1680 + 1440 = \underline{3120\ \text{lb}\cdot\text{ft}}$$

4-78



Find F so resultant couple = 450 lb·ft ccw where does it act?

$$M_1 = 200\ (1.5\ \text{ft}) = 300\ \text{ft}\cdot\text{lb}\ \circlearrowleft$$

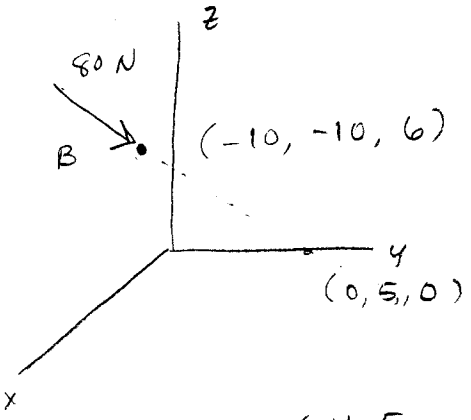
$$M_2 = F \cos 30^\circ\ (1.25\ \text{ft}) = 1.08\,F\ \circlearrowleft$$

$$M_R = 450\ \text{lb}\cdot\text{ft} = M_1 + M_2 = 300\ \text{ft}\cdot\text{lb} + 1.08\,F$$

$$F = \frac{450 - 300}{1.08} = \boxed{138.9\ \text{lb}}$$

M_R can act anywhere on the beam because it is a free vector

4-87

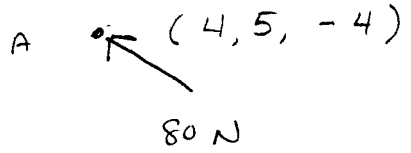


$\vec{r} = (0 - -10)(5 - -10)(0 - 6)$

$\vec{r} = 10\hat{i} + 15\hat{j} - 6\hat{k}$

$\vec{F}_B = 80\left[\frac{10\hat{i} + 15\hat{j} - 6\hat{k}}{\sqrt{10^2 + 15^2 + 6^2}}\right]$

$\vec{F}_B = 42.105\hat{i} + 63.158\hat{j} - 25.26\hat{k}$



* taking moment at A; could also take moment at B w/ Fa

$\vec{r}_{AB} = (-10 - 4)\hat{i} + (-10 - 5)\hat{j} + (6 - -4)\hat{k}$

$= -14\hat{i} - 15\hat{j} + 10\hat{k}$

$$\vec{M}_a = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -14 & -15 & 10 \\ 42.105 & 63.158 & -25.26 \end{vmatrix}$$

$\vec{r}_{AB}$

$\vec{F}_B$

$\boxed{\vec{M} = (-253\hat{i} + 67.4\hat{j} - 253\hat{k})\ N \cdot m}$