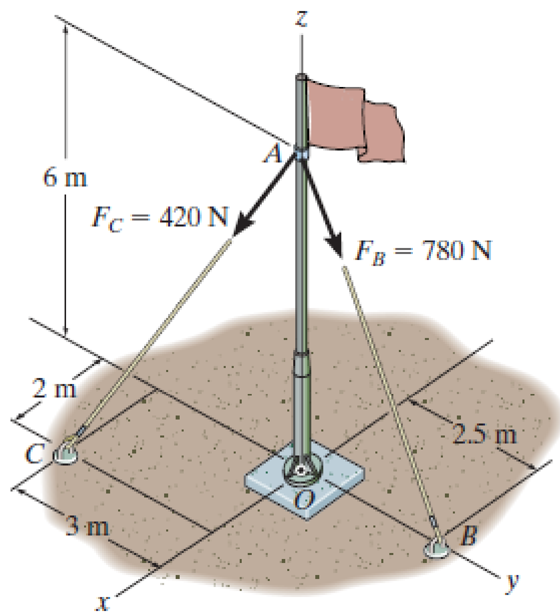
Philadelphia University **Faculty of Engineering**

Mech. Engineering Department **Statics(620211)**

Quiz:2-A .2d sem. 2015 **Dr.Nabil musa**

Detrmine the moment produce by force F_B about point O.



$\mathbf{r}_{OA} = [6\mathbf{k}]$ m $\mathbf{r}_{OB} = [2.5\mathbf{j}]$ m

The force vector $\mathbf{F}_B$ is given by

$$\mathbf{F}_B = F_B\mathbf{u}_{FB} = 780\left[\frac{(0-0)\mathbf{i}+(2.5-0)\mathbf{j}+(0-6)\mathbf{k}}{\sqrt{(0-0)^2+(2.5-0)^2+(0-6)^2}}\right] = [300\mathbf{j}-720\mathbf{k}]\text{N}$$

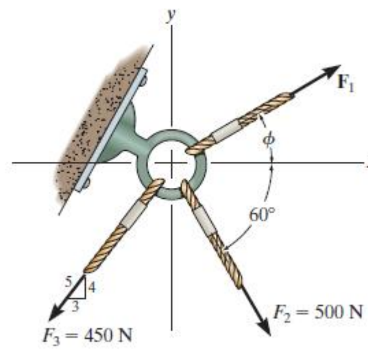
Vector Cross Product: The moment of $\mathbf{F}_B$ about point O is given by

$$\mathbf{M}_O = \mathbf{r}_{OA}\times\mathbf{F}_B = \begin{vmatrix}\mathbf{i} & \mathbf{j} & \mathbf{k}\\ 0 & 0 & 6\\ 0 & 300 & -720\end{vmatrix} = [-1800\mathbf{i}]\ \text{N}\cdot\text{m} = [-1.80\mathbf{i}]\text{kN}\cdot\text{m}$$

or

$$\mathbf{M}_O = \mathbf{r}_{OB}\times\mathbf{F}_B = \begin{vmatrix}\mathbf{i} & \mathbf{j} & \mathbf{k}\\ 0 & 2.5 & 0\\ 0 & 300 & -720\end{vmatrix} = [-1800\mathbf{i}]\ \text{N}\cdot\text{m} = [-1.80\mathbf{i}]\text{kN}\cdot\text{m}$$

•2–33. If $F_1 = 600$ N and $\phi = 30°$, determine the magnitude of the resultant force acting on the eyebolt and its direction measured clockwise from the positive x axis.



Rectangular Components: By referring to Fig. *a*, the x and y components of each force can be written as

$$(F_1)_x = 600\cos 30° = 519.62\text{ N} \quad (F_1)_y = 600\sin 30° = 300\text{ N}$$

$$(F_2)_x = 500\cos 60° = 250\text{ N} \quad (F_2)_y = 500\sin 60° = 433.0\text{ N}$$

$$(F_3)_x = 450\left(\frac{3}{5}\right) = 270\text{N} \quad (F_3)_y = 450\left(\frac{4}{5}\right) = 360\text{N}$$

Resultant Force: Summing the force components algebraically along the x and y axes,

$$\overset{+}{\rightarrow}\Sigma(F_R)_x = \Sigma F_x; \quad (F_R)_x = 519.62 + 250 - 270 = 499.62\text{ N} \rightarrow$$

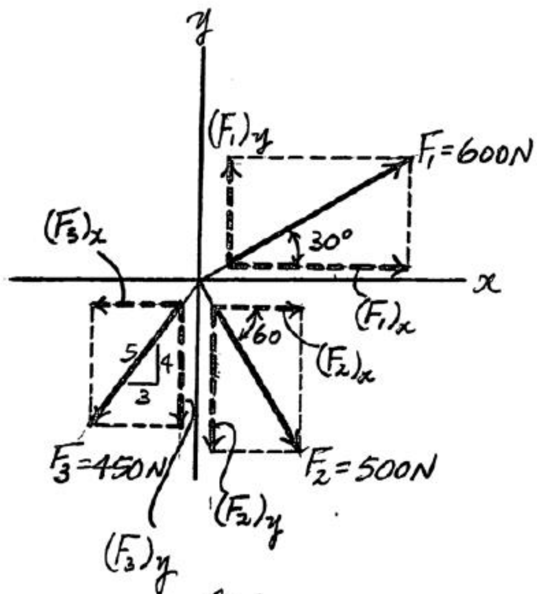
$$+\uparrow\Sigma(F_R)_y = \Sigma F_y; \quad (F_R)_y = 300 - 433.01 - 360 = -493.01\text{N} = 493.01\text{ N} \downarrow$$

The magnitude of the resultant force $\mathbf{F}_R$ is

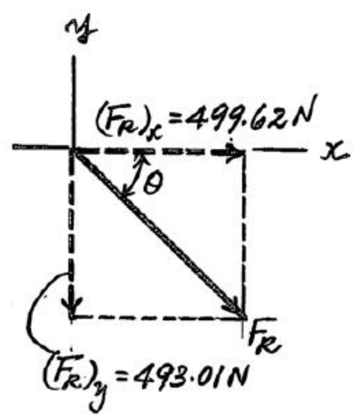
$$F_R = \sqrt{(F_R)_x{}^2 + (F_R)_y{}^2} = \sqrt{499.62^2 + 493.01^2} = 701.91\text{ N} = 702\text{ N}$$ **Ans.**

The direction angle θ of $\mathbf{F}_R$, Fig. *b*, measured clockwise from the x axis, is

$$\theta = \tan^{-1}\left[\frac{(F_R)_y}{(F_R)_x}\right] = \tan^{-1}\left(\frac{493.01}{499.62}\right) = 44.6°$$ **Ans.**



(a)



(b)