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2-34. If the magnitude of the resultant force acting on the eyebolt is 600 N and its direction measured clockwise from the positive  $x$  axis is  $\theta = 30^\circ$ , determine the magnitude of  $F_1$  and the angle  $\phi$ .



**Rectangular Components:** By referring to Figs. a and b, the  $x$  and  $y$  components of  $F_1$ ,  $F_2$ ,  $F_3$ , and  $F_R$  can be written as

$$\begin{aligned} (F_1)_x &= F_1 \cos \phi & (F_1)_y &= F_1 \sin \phi \\ (F_2)_x &= 500 \cos 60^\circ = 250 \text{ N} & (F_2)_y &= 500 \sin 60^\circ = 433.01 \text{ N} \\ (F_3)_x &= 450 \left(\frac{3}{5}\right) = 270 \text{ N} & (F_3)_y &= 450 \left(\frac{4}{5}\right) = 360 \text{ N} \\ (F_R)_x &= 600 \cos 30^\circ = 519.62 \text{ N} & (F_R)_y &= 600 \sin 30^\circ = 300 \text{ N} \end{aligned}$$

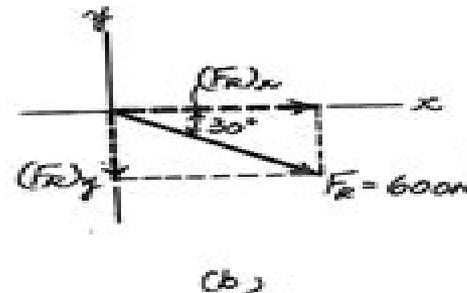
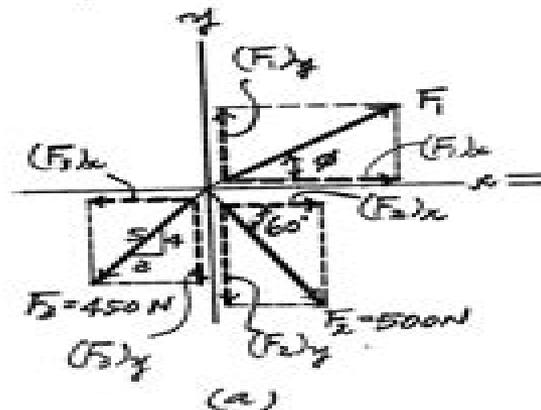
**Resultant Forces:** Summing the force components algebraically along the  $x$  and  $y$  axes,

$$\begin{aligned} \Sigma_x \Sigma (F_R)_x = \Sigma F_x: \quad 519.62 &= F_1 \cos \phi + 250 - 270 & (1) \\ F_1 \cos \phi &= 519.62 \end{aligned}$$

$$\begin{aligned} + \Sigma (F_R)_y = \Sigma F_y: \quad -300 &= F_1 \sin \phi - 433.01 - 360 & (2) \\ F_1 \sin \phi &= -493.01 \end{aligned}$$

Solving Eqs. (1) and (2), yields

$$\phi = 42.4^\circ \quad F_1 = 391 \text{ N} \quad \text{Ans.}$$



# Hibbeler 12th Edition Solution

**Michal Rosen-Zvi**



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