



Philadelphia University

Faculty of Engineering

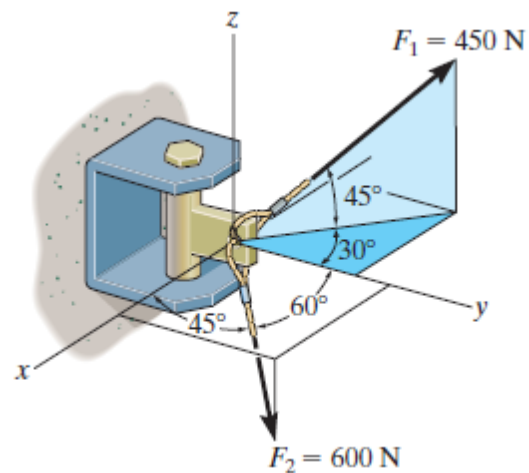
Mech. Engineering Department

Statics(620211)

Quiz:1-A .1<sup>st</sup> sem. 2014/15

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Determine the coordinate angle  $\gamma$  for  $F_2$  and then express each force as a Cartesian vector.



**Rectangular Components:** Since  $\cos^2 \alpha_2 + \cos^2 \beta_2 + \cos^2 \gamma_2 = 1$ , then  $\cos \gamma_{2z} = \pm \sqrt{1 - \cos^2 45^\circ - \cos^2 60^\circ} = \pm 0.5$ .

However, it is required that  $\gamma_2 > 90^\circ$ , thus,  $\gamma_2 = \cos^{-1}(-0.5) = 120^\circ$ . By resolving  $F_1$  and  $F_2$  into their  $x$ ,  $y$ , and  $z$  components, as shown in Figs. *a* and *b*, respectively  $F_1$  and  $F_2$  can be expressed in Cartesian vector form as

$$\begin{aligned} F_1 &= 450 \cos 45^\circ \sin 30^\circ (-i) + 450 \cos 45^\circ \cos 30^\circ (+j) + 450 \sin 45^\circ (+k) \\ &= \{-159i + 276j + 318k\} \text{N} \quad \text{Ans.} \end{aligned}$$

$$\begin{aligned} F_2 &= 600 \cos 45^\circ i + 600 \cos 60^\circ j + 600 \cos 120^\circ k \\ &= \{424i + 300j - 300k\} \text{N} \quad \text{Ans.} \end{aligned}$$