CE 201-2 (041)

Quiz #2

Prob. 2-77 (P. 54)

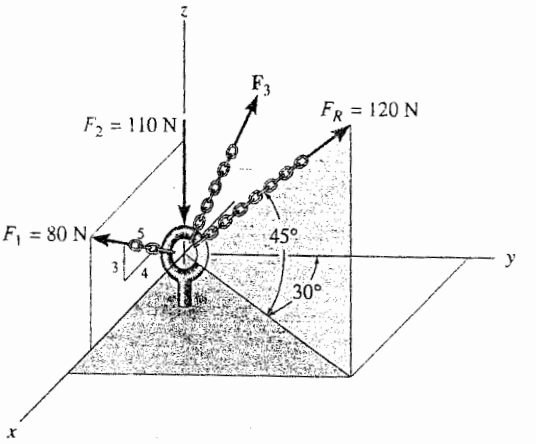

Fig-1

Given:

Forces shown in Fig-1
Resultant force given

Req.d:

The magnitude and the coordinate direction angles of forces F_3

Soln:

$$\vec{F}_1 = \frac{80}{5} * 4\vec{i} + \frac{80}{5} * 3\vec{k}$$

$$\therefore \vec{F}_1 = 64\vec{i} + 48\vec{k}$$

$$\vec{F}_2 = -110\vec{k}$$

$$\vec{F}_R = 120 \cos 45 * \sin 30\,\vec{i} + 120 \cos 45^\circ \cos 30\,\vec{j} + 120 \sin 45^\circ \vec{k}$$

$$\vec{F}_R = 42.426\vec{i} + 73.48\vec{j} + 84.85\vec{k}$$

$$\vec{F}_3 = F_3 \cos\alpha\,\vec{i} + F_3 \cos\beta\,\vec{j} + F_3 \cos\gamma\,\vec{k} = F_{3x}\vec{i} + F_{3y}\vec{j} + F_{3z}\vec{k}$$

$$\vec{F}_R = \vec{F}_1 + \vec{F}_2 + \vec{F}_3$$

$$\Rightarrow (42.426\vec{i} + 73.48\vec{j} + 84.85\vec{k}) = (64\vec{i} + 48\vec{k}) + (-110\vec{k}) + (F_3 \cos\alpha\,\vec{i} + F_3 \cos\beta\,\vec{j} + F_3 \cos\gamma\,\vec{k})$$

$$\Rightarrow 42.426 = 64 + F_3 \cos\alpha \quad \therefore F_3 \cos\alpha = -21.574\ \text{N} = F_{3x}$$

$$\Rightarrow 73.48 = F_3 \cos\beta \quad \therefore F_3 \cos\beta = 73.48\ \text{N} = F_{3y}$$

$$\Rightarrow 84.85 = 48k - 110k + F_3 \cos\gamma \quad \therefore F_3 \cos\gamma = 146.85\ \text{N} = F_{3z}$$

$$F_3 = \sqrt{(-21.574)^2 + (73.48)^2 + (146.85)^2} = 166\ \text{N} \quad \therefore \boxed{F_3 = 166\ \text{N}}$$

$$\therefore \boxed{\alpha = 97.5^\circ} = \theta_x$$

$$\boxed{\beta = 63.73^\circ} \text{ & } \boxed{\gamma = 27.8^\circ} = \theta_z$$

$\Big\}$ $\cos\theta_x = \dfrac{F_{3x}}{F_3}$ etc.