

Name: Key
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Quiz # 2

Score _____
10

If the resultant force acting on the hook is $F_R = \{-200i + 800j + 150k\}$ N, determine the magnitude and coordinate direction angles of F .

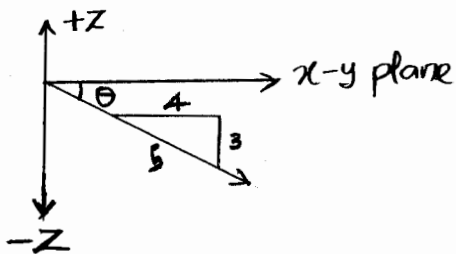


Fig. 1 - x-y plane and z-axis

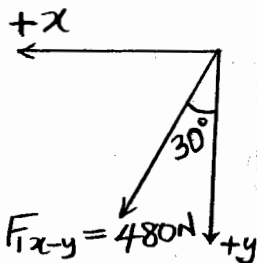
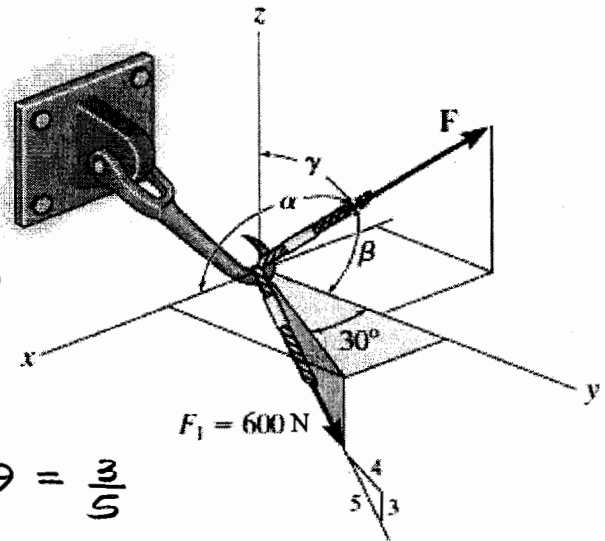


Fig. 2 - x-y plane



From fig 1, $\cos\theta = \frac{4}{5}$, $\sin\theta = \frac{3}{5}$

$$F_{iz} = -F_1 \sin\theta = -600 \times \frac{3}{5} = -360 \text{ N}$$

$$F_{ix-y} = +F_1 \cos\theta = +600 \times \frac{4}{5} = 480 \text{ N}$$

From Fig. 2,

$$F_{ix} = F_{ix-y} \sin 30^\circ = 480 \times 0.5 = 240 \text{ N}$$

$$F_{iy} = F_{ix-y} \cos 30^\circ = 480 \times 0.866 = 415.68 \text{ N}$$

$$\vec{F}_1 = F_{ix} \vec{i} + F_{iy} \vec{j} + F_{iz} \vec{k} = 240 \vec{i} + 415.68 \vec{j} - 360 \vec{k}$$

$$\text{Also, } \vec{F} = \vec{F}_R - \vec{F}_1 = -440 \vec{i} + 384.32 \vec{j} + 510 \vec{k}$$

$$|\vec{F}| = \sqrt{(440^2 + 384.32^2 + 510^2)} \Rightarrow \boxed{F = 775.5 \text{ N}}$$

$$\theta_x = \alpha = \cos^{-1} \frac{F_x}{|F|} = \cos^{-1} \left(\frac{-440}{775.5} \right) \Rightarrow \boxed{\alpha = 124.6^\circ}$$

Similarly,

$$\theta_y = \beta = \cos^{-1} \left(\frac{384.32}{775.5} \right) \boxed{\beta = 60.3^\circ} \quad \theta_z = \gamma = \cos^{-1} \left(\frac{510}{775.5} \right) \boxed{\gamma = 48.9^\circ}$$

Hence, the magnitude of $F = 775.5 \text{ N}$, and its coordinate direction angles are respectively 124.6° , 60.3° and 48.9°

$$\text{Confirm that } \cos^2 124.6^\circ + \cos^2 60.3^\circ + \cos^2 48.9^\circ = 1$$