

ME 205 – STATICS – FALL 2014
SECTION 04

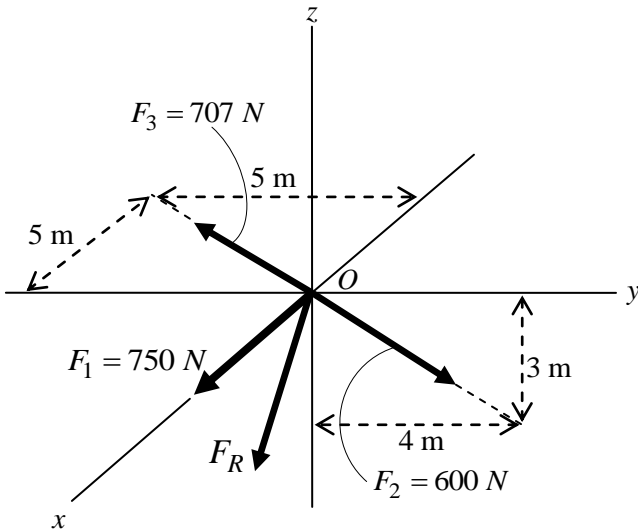
HOMEWORK #1 SOLUTION

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Room: C-206

Problem

In the figure below,



- Find the unit vectors along the given forces F_1 , F_2 and F_3 .
- Determine the magnitude and the unit vector of the resultant force, F_R for the given three forces.
- Find the angle between the forces F_3 and F_R .

SOLUTION

- a)** Unit vectors along the given forces F_1 , F_2 and F_3 can be written as,

$$\vec{u}_1 = i$$

$$\vec{u}_2 = \frac{4j - 3k}{\sqrt{3^2 + 4^2}} = 0.8j - 0.6k$$

$$\vec{u}_3 = \frac{-5i - 5j}{\sqrt{5^2 + 5^2}} = -0.707i - 0.707j$$

- b)** The magnitude and the unit vector of the resultant force, F_R for the given three forces can be found as,

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

$$\vec{F}_R = (750)(i) + (600)(0.8j - 0.6k) + (707)(-0.707i - 0.707j)$$

$$\vec{F}_R = \{250i - 20j - 360k\} \text{ N}$$

$$|\vec{F}_R| = \sqrt{250^2 + (-20)^2 + (-360)^2} \rightarrow |\vec{F}_R| = 438.8 \text{ N}$$

$$\vec{u}_{F_R} = \frac{250i - 20j - 360k}{438.8} = 0.570i - 0.046j - 0.820k$$

- c)** The angle between the forces F_3 and F_R can be found as,

$$\vec{F}_3 \cdot \vec{F}_R = |\vec{F}_3||\vec{F}_R|\cos\theta \rightarrow \cos\theta = \frac{\vec{F}_3 \cdot \vec{F}_R}{|\vec{F}_3||\vec{F}_R|}$$

$$\cos\theta = \frac{[(707)(-0.707i - 0.707j)] \cdot (250i - 20j - 360k)}{(707) \cdot (438.8)} = -0.3707$$

$$\theta = \cos^{-1}(-0.3707) = 111.76^\circ$$