

Engineering Calculation Report: Problem 2-6

November 29, 2025

1 Known Variables

Vector	F_x (N)	F_y (N)	$ \vec{F} $ (N)	θ (deg)	Reference
\vec{F}_1	2828.4	2828.4	4000.0	-30.0	+v
\vec{F}_2	5196.2	-3000.0	6000.0	-30.0	+u

2 Unknown Variables

Vector	F_x (N)	F_y (N)	$ \vec{F} $ (N)	θ (deg)	Reference
\vec{F}_R	?	?	?	?	+u

3 Equations Used

1. $|\vec{F}_R|^2 = |\vec{F}_1|^2 + |\vec{F}_2|^2 + 2 \cdot |\vec{F}_1| \cdot |\vec{F}_2| \cdot \cos(\angle(\vec{F}_1, \vec{F}_2))$
2. $\frac{\sin(\angle(\vec{F}_2, \vec{F}_R))}{|\vec{F}_1|} = \frac{\sin(\angle(\vec{F}_1, \vec{F}_2))}{|\vec{F}_R|}$

4 Step-by-Step Solution

Step 1: Solve for $\angle(\vec{F}_1, \vec{F}_2)$

$$\begin{aligned}\angle(\vec{F}_1, \vec{F}_2) &= 180^\circ - \angle(\vec{v}, \vec{u}) \\ &= 180^\circ - 75^\circ \\ &= 105^\circ\end{aligned}$$

Step 2: Solve for $|\vec{F}_R|$ using Eq 1

$$\begin{aligned}|\vec{F}_R| &= \sqrt{(4000.0)^2 + (6000.0)^2 + 2(4000.0)(6000.0) \cos(105^\circ)} \\ &= 8026.4 \text{ N}\end{aligned}$$

Step 3: Solve for $\angle(\vec{F}_2, \vec{F}_R)$ using Eq 2

$$\begin{aligned}\angle(\vec{F}_2, \vec{F}_R) &= \sin^{-1}(4000.0 \cdot \frac{\sin(105^\circ)}{8026.4}) \\ &= 28.8^\circ\end{aligned}$$

Step 4: Solve for $\angle(\vec{x}, \vec{F}_R)$ with respect to +x

$$\begin{aligned}\angle(\vec{x}, \vec{F}_R) &= \angle(\vec{u}, \vec{F}_2) + \angle(\vec{F}_2, \vec{F}_R) \\ &= -30.0^\circ + 28.8^\circ \\ &= -1.2^\circ\end{aligned}$$

5 Summary of Results

Vector	F_x (N)	F_y (N)	$ \vec{F} $ (N)	θ (deg)	Reference
\vec{F}_R	8024.6	-171.6	8026.4	-1.2	+u

Disclaimer

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