

Engineering Calculation Report: Problem 2-3

November 28, 2025

1 Known Variables

Vector	F_x (N)	F_y (N)	$ \vec{F} $ (N)	θ (deg)	Reference
\vec{F}_1	125.0	216.5	250.0	-30.0	+y
\vec{F}_2	265.2	-265.2	375.0	-45.0	+x

2 Unknown Variables

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

3 Equations Used

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

$$2. \frac{\sin(\angle(\vec{F}_1, \vec{F}_R))}{|\vec{F}_2|} = \frac{\sin(\angle(\vec{F}_1, \vec{F}_2))}{|\vec{F}_R|}$$

4 Step-by-Step Solution

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

$$\begin{aligned}\angle(\vec{F}_1, \vec{F}_2) &= |\angle(\vec{y}, \vec{F}_1) - \angle(\vec{x}, \vec{F}_2)| \\ &= |-30^\circ - -45^\circ| \\ &= 75^\circ\end{aligned}$$

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

$$\begin{aligned}|\vec{F}_R| &= \sqrt{(250.0)^2 + (375.0)^2 + 2(250.0)(375.0)\cos(75^\circ)} \\ &= 393.2 N\end{aligned}$$

Step 3: Solve for $\angle(\vec{F}_1, \vec{F}_R)$ using Eq 2

$$\begin{aligned}\angle(\vec{F}_1, \vec{F}_R) &= \sin^{-1}(375.0 \cdot \frac{\sin(75^\circ)}{393.2}) \\ &= 292.9^\circ\end{aligned}$$

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

$$\begin{aligned}\angle(\vec{x}, \vec{F}_R) &= \angle(\vec{y}, \vec{F}_1) + \angle(\vec{F}_1, \vec{F}_R) \\ &= 60.0^\circ + 292.9^\circ \\ &= 352.9^\circ\end{aligned}$$

5 Summary of Results

Vector	F_x (N)	F_y (N)	$ \vec{F} $ (N)	θ (deg)	Reference
\vec{F}_R	390.2	-48.7	393.2	352.9	+x

Disclaimer

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