

Engineering Calculation Report: Problem 2-12

2025-12-08

1 Known Variables

Vector	$ \vec{F} $ (N)	θ (deg)	Reference
\vec{F}_B	6000.0	40.0	$-y$

2 Unknown Variables

Vector	$ \vec{F} $ (N)	θ (deg)	Reference
\vec{F}_A	8000.0	?	$+y$
\vec{F}_R	?	0.0	$+x$

3 Equations Used

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

4 Step-by-Step Solution

Step 1: Solve for $\angle(\vec{F}_A, \vec{F}_R)$ using Eq 1

$$\begin{aligned}\angle(\vec{F}_A, \vec{F}_R) &= \sin^{-1}(6000.0 \text{ N} \cdot \frac{\sin(50.0^\circ)}{8000.0 \text{ N}}) \\ &= 35.1^\circ\end{aligned}$$

Step 2: Solve for $\angle(y, \vec{F}_A)$ with respect to $+y$

$$\begin{aligned}\angle(y, \vec{F}_A) &= 90^\circ - \angle(\vec{F}_B, \vec{F}_A) \\ &= 90^\circ - 35.1^\circ \\ &= 54.9^\circ\end{aligned}$$

Step 3: Solve for *Interior angle opposite F_R*

$$180 - 50.0^\circ - 35.1^\circ = 94.9^\circ$$

Step 4: Solve for $|\vec{F}_R|$ using Eq 2

$$\begin{aligned} |\vec{F}_R| &= \sqrt{(8000.0 \text{ N})^2 + (6000.0 \text{ N})^2 - 2(8000.0 \text{ N})(6000.0 \text{ N}) \cos(94.9^\circ)} \\ &= 10404.6 \text{ N} \end{aligned}$$

5 Summary of Results

Vector	$ \vec{F} $ (N)	θ (deg)	Reference
\vec{F}_A	8000.0	324.9	+y
\vec{F}_R	10404.6	0.0	+x

Disclaimer

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