

# Engineering Calculation Report: Problem 2-12

2025-12-08

## 1 Known Variables

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

## 2 Unknown Variables

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

## 3 Equations Used

1. 
$$\frac{\sin(\angle(\vec{F}_R, \vec{F}_A))}{|\vec{F}_B|} = \frac{\sin(\angle(\vec{F}_B, \vec{F}_A))}{|\vec{F}_A|}$$
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  $\angle(\vec{F}_R, \vec{F}_A)$  using Eq 1

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

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

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

**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)	$\theta$ (deg)	Reference
$\vec{F}_A$	8000.0	305.1	+y
$\vec{F}_R$	10404.6	0.0	+x

## Disclaimer

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