

# Engineering Calculation Report: Problem 2-2

2025-12-08

## 1 Known Variables

Vector	$ \vec{F} $ (N)	$\theta$ (deg)	Reference
$\vec{F}_2$	700.0	15.0	$-x$
$\vec{F}_R$	500.0	0.0	$+y$

## 2 Unknown Variables

Vector	$ \vec{F} $ (N)	$\theta$ (deg)	Reference
$\vec{F}_1$	?	?	$+x$

## 3 Equations Used

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

## 4 Step-by-Step Solution

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

$$\begin{aligned}\angle(\vec{F}_1, \vec{F}_2) &= \sin^{-1}\left(500.0 \text{ N} \cdot \frac{\sin(105.0^\circ)}{700.0 \text{ N}}\right) \\ &= 43.6^\circ\end{aligned}$$

**Step 2: Solve for  $\text{Interior angle opposite } F_1$**

$$180 - 105.0^\circ - 43.6^\circ = 31.4^\circ$$

**Step 3: Solve for  $|\vec{F}_1|$  using Eq 2**

$$\begin{aligned}|\vec{F}_1| &= \sqrt{(700.0 \text{ N})^2 + (500.0 \text{ N})^2 - 2(700.0 \text{ N})(500.0 \text{ N})\cos(31.4^\circ)} \\ &= 377.3 \text{ N}\end{aligned}$$

## 5 Summary of Results

Vector	$ \vec{F} $ (N)	$\theta$ (deg)	Reference
$\vec{F}_1$	?	?	$+x$

### Disclaimer

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