

# Engineering Calculation Report: Problem 2-1

November 28, 2025

## 1 Known Variables

Vector	$F_x$ (N)	$F_y$ (N)	$ \vec{F} $ (N)	$\theta$ (deg)	Reference
$\vec{F}_1$	225.0	389.7	450.0	60.0	+x
$\vec{F}_2$	-676.1	-181.2	700.0	15.0	-x

## 2 Unknown Variables

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

## 3 Equations Used

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

## 4 Step-by-Step Solution

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

$$\begin{aligned}\angle(\vec{F}_1, \vec{F}_2) &= |\angle(\vec{x}, \vec{F}_1) - \angle(-\vec{x}, \vec{F}_2)| \\ &= |60^\circ - 15^\circ| \\ &= 45^\circ\end{aligned}$$

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

$$\begin{aligned}|\vec{F}_R| &= \sqrt{(450.0)^2 + (700.0)^2 + 2(450.0)(700.0)\cos(45^\circ)} \\ &= 497.0N\end{aligned}$$

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

$$\begin{aligned}\angle(\vec{F}_1, \vec{F}_R) &= \sin^{-1}\left(700.0 \cdot \frac{\sin(45^\circ)}{497.0}\right) \\ &= 95.2^\circ\end{aligned}$$

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

$$\begin{aligned}\angle(\vec{x}, \vec{F}_R) &= \angle(\vec{x}, \vec{F}_1) + \angle(\vec{F}_1, \vec{F}_R) \\ &= 60.0^\circ + 95.2^\circ \\ &= 155.2^\circ\end{aligned}$$

## 5 Summary of Results

Vector	$F_x$ (N)	$F_y$ (N)	$ \vec{F} $ (N)	$\theta$ (deg)	Reference
$\vec{F}_R$	-451.1	208.5	497.0	155.2	$+x$

## Disclaimer

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