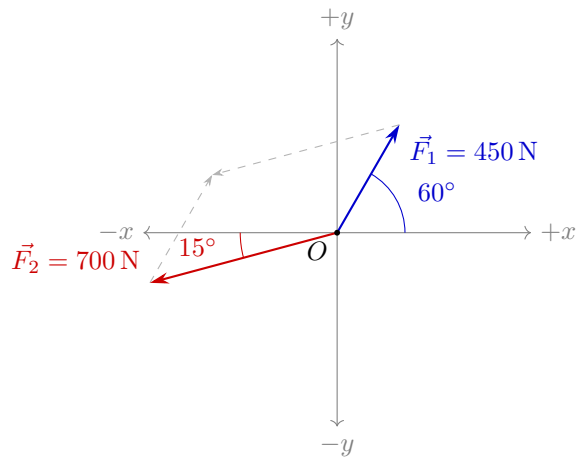


Engineering Calculation Report: Problem 2-1

Generated: 2025-12-08

Problem Setup

Vector	$ \vec{F} $ (N)	θ (deg)	Ref
\vec{F}_1	450.0	60.0	$+x$
\vec{F}_2	700.0	15.0	$-x$
\vec{F}_R	?	?	$+x$



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

Solution

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

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

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

$$|\vec{F}_R| = \sqrt{(450.0 \text{ N})^2 + (700.0 \text{ N})^2 - 2(450.0 \text{ N})(700.0 \text{ N})\cos(45.0^\circ)} = 497.0 \text{ N}$$

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

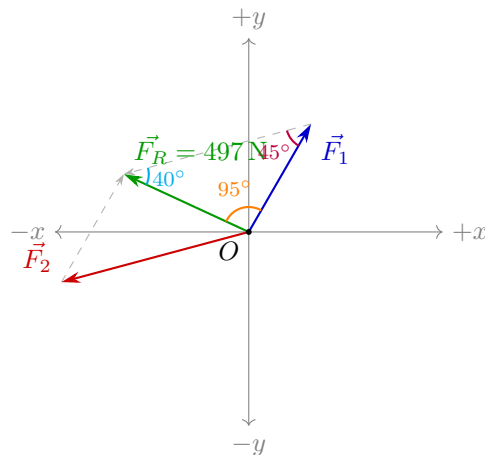
$$\angle(\vec{F}_1, \vec{F}_R) = \sin^{-1}(700.0 \text{ N} \cdot \frac{\sin(45.0^\circ)}{497.0 \text{ N}}) = 95.2^\circ$$

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

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

Results

Vector	$ \vec{F} $ (N)	θ (deg)	Ref
\vec{F}_R	497.0	155.2	$+x$



Signatures: Calc. By: _____ Rev. By: _____ Appr. By: _____

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