Engineering Calculation Report: Problem 2-1

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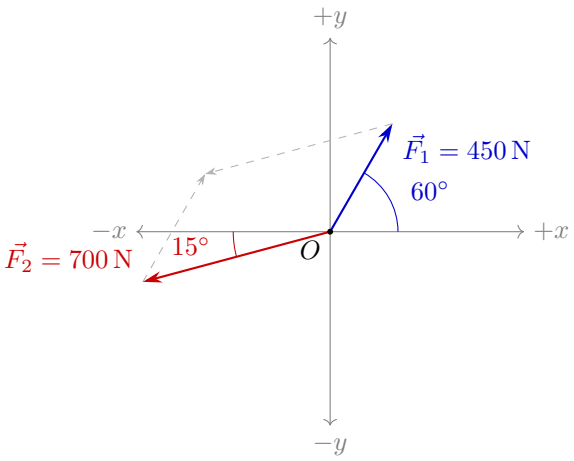
Problem Setup

Vector	$\lvert\vec{F}\rvert$ (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) $\dfrac{\sin(\angle(\vec{F}_1, \vec{F}_R))}{|\vec{F}_2|} = \dfrac{\sin(\angle(\vec{F}_1, \vec{F}_2))}{|\vec{F}_R|}$

Solution

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

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

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

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

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

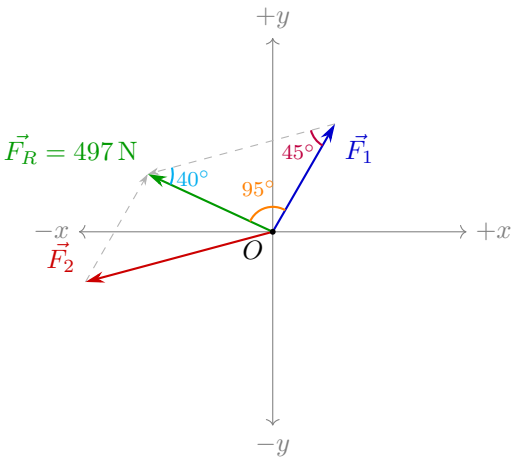
$\angle(\vec{F}_1, \vec{F}_R) = \sin^{-1}(700.0\ \text{N} \cdot \frac{\sin(45.0°)}{497.0\ \text{N}}) = 95.2°$

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

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

Results

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



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