Engineering Calculation Report: Problem 2-12

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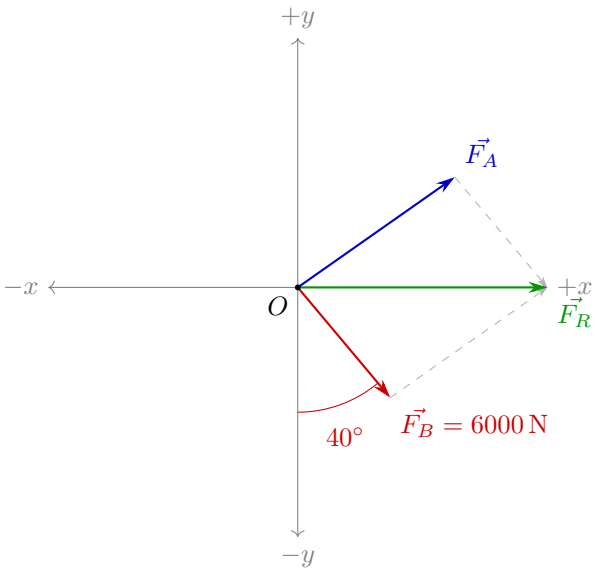
Problem Setup

Vector	$\lvert\vec{F}\rvert$ (N)	θ (deg)	Ref
$\vec{F}_B$	6000.0	40.0	$-y$
$\vec{F}_A$	8000.0	?	$+y$
$\vec{F}_R$	?	0.0	$+x$



Equations Used

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

(2) $$|\vec{F}_R|^2 = |\vec{F}_A|^2 + |\vec{F}_B|^2 - 2 \cdot |\vec{F}_A| \cdot |\vec{F}_B| \cdot \cos(\angle(\vec{F}_A, \vec{F}_B))$$

Solution

Step 1: $\angle(\vec{F}_A, \vec{F}_R)$ using Eq 1

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

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

$\angle(y, \vec{F}_A) = 90° - \angle(\vec{F}_R, \vec{F}_A) = 90° - 35.1° = 54.9°$

Step 3: $Interiorangle opposite F_R$

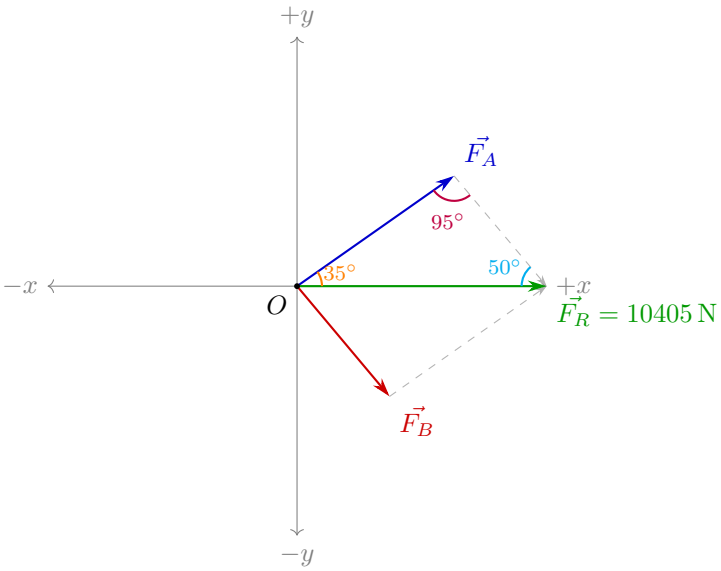
$180 - 50.0° - 35.1° = 94.9°$

Step 4: $|\vec{F}_R|$ using Eq 2

$|\vec{F}_R| = \sqrt{(8000.0\ \text{N})^2 + (6000.0\ \text{N})^2 - 2(8000.0\ \text{N})(6000.0\ \text{N})\cos(94.9°)} = 10404.6\ \text{N}$

Results

Vector	$\lvert\vec{F}\rvert$ (N)	θ (deg)	Ref
$\vec{F}_A$	8000.0	305.1	$+y$
$\vec{F}_R$	10 404.6	0.0	$+x$



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