Engineering Calculation Report: Problem 2-6

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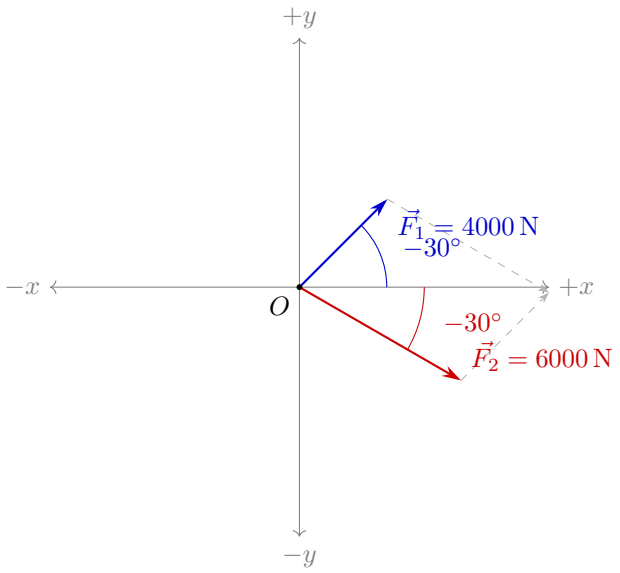
Problem Setup

Vector	$\lvert\vec{F}\rvert$ (N)	θ (deg)	Ref
$\vec{F}_1$	4000.0	-30.0	$+v$
$\vec{F}_2$	6000.0	-30.0	$+u$
$\vec{F}_R$	?	?	$+u$



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

$\angle(\vec{F}_1, \vec{F}_2) = |\angle(\vec{v}, \vec{F}_1)| + |\angle(\vec{u}, \vec{F}_2)| = |(-30°)| + |(-30°)| = 30° + 30° = 105°$

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

$|\vec{F}_R| = \sqrt{(4000.0\text{ N})^2 + (6000.0\text{ N})^2 - 2(4000.0\text{ N})(6000.0\text{ N})\cos(105.0°)} = 8026.4\text{ N}$

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

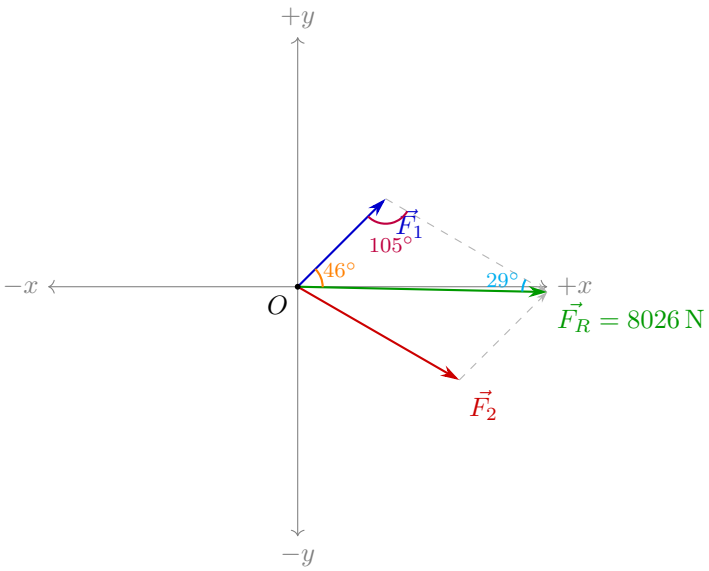
$\angle(\vec{F}_1, \vec{F}_R) = \sin^{-1}(6000.0\text{ N} \cdot \frac{\sin(105.0°)}{8026.4\text{ N}}) = 46.2°$

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

$\angle(\vec{u}, \vec{F}_R) = \angle(\vec{u}, \vec{F}_1) - \angle(\vec{F}_1, \vec{F}_R) = 45.0° - 46.2° = -1.2°$

Results

Vector	$\lvert\vec{F}\rvert$ (N)	θ (deg)	Ref
$\vec{F}_R$	8026.4	-1.2	$+u$



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

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