Engineering Calculation Report: Problem 2-3

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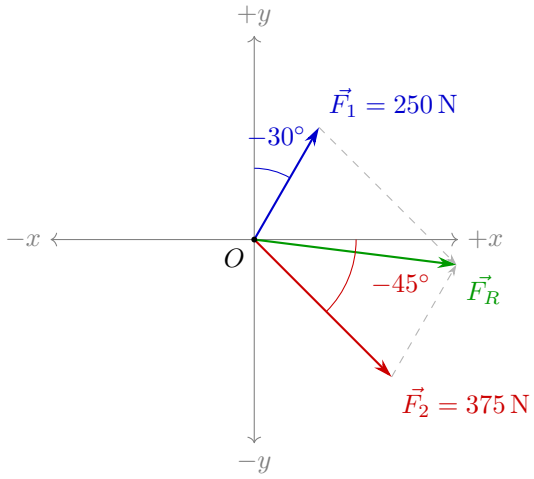
Problem Setup

Vector	$\lvert\vec{F}\rvert$ (N)	θ (deg)	Ref
$\vec{F}_1$	250.0	-30.0	$+y$
$\vec{F}_2$	375.0	-45.0	$+x$
$\vec{F}_R$	?	?	$+x$



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: $\angle(\vec{F_1}, \vec{F_2})$

$\angle(\vec{F_1}, \vec{F_2}) = |\angle(\vec{y}, \vec{F_1})| + |\angle(\vec{x}, \vec{F_2})| = |(-30°)| + |(-45°)| = 75°$

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

$|\vec{F_R}| = \sqrt{(250.0\text{ N})^2 + (375.0\text{ N})^2 - 2(250.0\text{ N})(375.0\text{ N})\cos(75.0°)} = 393.2\text{ N}$

Step 3: $\angle(\vec{F_1}, \vec{F_R})$ using Eq 2

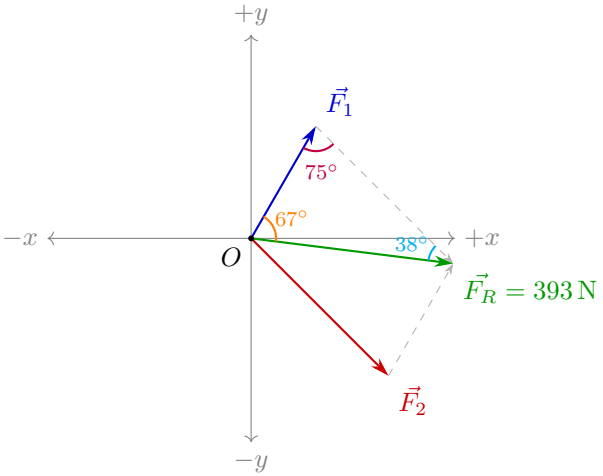
$\angle(\vec{F_1}, \vec{F_R}) = \sin^{-1}(375.0\text{ N} \cdot \frac{\sin(75.0°)}{393.2\text{ N}}) = 67.1°$

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

$\angle(\vec{x}, \vec{F_R}) = \angle(\vec{x}, \vec{F_1}) - \angle(\vec{F_1}, \vec{F_R}) = 360° + 60.0° - 67.1° = 352.9°$

Results

Vector	$\lvert\vec{F}\rvert$ (N)	θ (deg)	Ref
$\vec{F_R}$	393.2	352.9	$+x$



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