Engineering Calculation Report: Problem 2-1

2025-12-04

1 Known Variables

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

2 Unknown Variables

Vector	$|\vec{F}|$ (N)	θ (deg)	Reference
$\vec{F}_R$	?	?	+x

3 Equations Used

1. $|\vec{F_R}|^2 = |\vec{F_2}|^2 + |\vec{F_1}|^2 - 2 \cdot |\vec{F_2}| \cdot |\vec{F_1}| \cdot \cos(\angle(\vec{F_2}, \vec{F_1}))$

2. $\dfrac{\sin(\angle(\vec{F_1}, \vec{F_R}))}{|\vec{F_2}|} = \dfrac{\sin(\angle(\vec{F_1}, \vec{F_2}))}{|\vec{F_R}|}$

4 Step-by-Step Solution

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

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

Step 2: Solve for $\angle(\vec{F_1}, \vec{F_R})$ 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 3: Solve for $\angle(\vec{x}, \vec{F_R})$ with respect to +x

$$\angle(\vec{x}, \vec{F_R}) = \angle(\vec{x}, \vec{F_1}) + \angle(\vec{F_1}, \vec{F_R})$$
$$= 60.0° + 95.2°$$
$$= 155.2°$$

5 Summary of Results

Vector	$|\vec{F}|$ (N)	θ (deg)	Reference
$\vec{F_R}$	497.0	155.2	+x

Disclaimer

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