Engineering Calculation Report: Problem 2-4

November 30, 2025

1 Known Variables

Vector	F_x (N)	F_y (N)	$\lvert\vec{F}\rvert$ (N)	θ (deg)	Reference
$\vec{F_R}$	0.0	-500.0	500.0	0.0	-y

2 Unknown Variables

Vector	F_x (N)	F_y (N)	$\lvert\vec{F}\rvert$ (N)	θ (deg)	Reference
$\vec{F_{AB}}$	?	?	?	-45.0	-y
$\vec{F_{AC}}$	?	?	?	-30.0	+x

3 Equations Used

1. $$\frac{|\vec{F_{AB}}|}{\sin(\angle(\vec{F_{AC}}, \vec{F_R}))} = \frac{|\vec{F_R}|}{\sin(\angle(\vec{F_{AB}}, \vec{F_{AC}}))}$$
2. $$\frac{|\vec{F_{AC}}|}{\sin(\angle(\vec{F_{AB}}, \vec{F_R}))} = \frac{|\vec{F_R}|}{\sin(\angle(\vec{F_{AB}}, \vec{F_{AC}}))}$$

4 Step-by-Step Solution

Step 1: Solve for triangle angles

$$\begin{aligned}
\angle(\vec{F_{AB}}, \vec{F_R}) &= |\angle(-\vec{y}, \vec{F_{AB}}) - \angle(-\vec{y}, \vec{F_R})| \\
&= |-45^\circ - 0^\circ| \\
&= 45^\circ \\
\angle(\vec{F_{AC}}, \vec{F_R}) &= 90^\circ - |\angle(\vec{x}, \vec{F_{AC}})| \\
&= 90^\circ - |-30^\circ| \\
&= 60^\circ \\
\angle(\vec{F_{AB}}, \vec{F_{AC}}) &= 180^\circ - 45^\circ - 60^\circ \\
&= 75^\circ
\end{aligned}$$

Step 2: Solve for $|\vec{F_{AB}}|$ using Eq 1

$$|\vec{F_{AB}}| = 500 \cdot \frac{\sin(60°)}{\sin(75°)}$$
$$= 448 \text{ N}$$

Step 3: Solve for $|\vec{F_{AC}}|$ using Eq 2

$$|\vec{F_{AC}}| = 500 \cdot \frac{\sin(45°)}{\sin(75°)}$$
$$= 366 \text{ N}$$

5 Summary of Results

Vector	F_x (N)	F_y (N)	$\lvert\vec{F}\rvert$ (N)	θ (deg)	Reference
$\vec{F_{AB}}$	-317.0	-317.0	448.3	-45.0	-y
$\vec{F_{AC}}$	317.0	-183.0	366.0	-30.0	+x

Disclaimer

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