Engineering Calculation Report: Problem 1

October 13, 2025

Description

If \\$theta = 60\textasciicircum\\circ\\$ and \$F = 450\mathrm\\textasciitildeN\\$, determine the magnitude of the resultant force and its direction, measured counterclockwise from the positive \$x\$ axis.

1 Known Variables

Symbol	Name	Value	Unit
$F_{1_{mag}}$	F 1 Magnitude	450	N
$F_{1_{angle}}$	F 1 Direction	60	°
$F_{2_{mag}}$	F 2 Magnitude	700	N
$F_{2_{angle}}$	F 2 Direction	-165	°

2 Unknown Variables (To Calculate)

Symbol	Name	Unit
F_{1_x}	F 1 X-Component	N
F_{1_y}	F 1 Y-Component	N
F_{2_x}	F 2 X-Component	N
F_{2_y}	F 2 Y-Component	N
$F_{R_{mag}}$	Resultant Force Magnitude	N
$F_{R_{angle}}$	Resultant Force Direction	°
F_{R_x}	Resultant Force X-Component	N
F_{R_y}	Resultant Force Y-Component	N

3 Equations Used

1. $ResultantForce^2 = F1^2 + F2^2 - 2 \cdot F1 \cdot F2 \cdot \cos gamma$
2. $\frac{\sin alpha}{F1} = \frac{\sin gamma}{ResultantForce}$

4 Step-by-Step Solution

Step 1: Solve for $ResultantForceMagnitude$

Equation:

$$ResultantForce^2 = F1^2 + F2^2 - 2 \cdot F1 \cdot F2 \cdot \cos gamma$$

Substitution:

$$ResultantForce^2 = (450.00\,\mathrm{N})^2 + (700.00\,\mathrm{N})^2 - 2 \cdot (450.00\,\mathrm{N}) \cdot (700.00\,\mathrm{N}) \cdot \cos 45.0^\circ$$

Result:

$$ResultantForceMagnitude = 497.01\,N$$

Step 2: Solve for $ResultantForceDirection$

Equation:

$$\frac{\sin alpha}{F1} = \frac{\sin gamma}{ResultantForce}$$

Substitution:

$$\frac{\sin alpha}{450.00\,\mathrm{N}} = \frac{\sin 45.0^\circ}{497.01\,\mathrm{N}}$$

Result:

$$ResultantForceDirection = 155.19\,^\circ$$

5 Summary of Results

Variable	Name	Final Value	Unit
F_{1_x}	F 1 X-Component	225	N
F_{1_y}	F 1 Y-Component	389.711	N
F_{2_x}	F 2 X-Component	-676.148	N
F_{2_y}	F 2 Y-Component	-181.173	N
F_{R_mag}	Resultant Force Magnitude	497.014	N
F_{R_angle}	Resultant Force Direction	2.70861	°
F_{R_x}	Resultant Force X-Component	-451.148	N
F_{R_y}	Resultant Force Y-Component	208.538	N

6 Vector Diagram

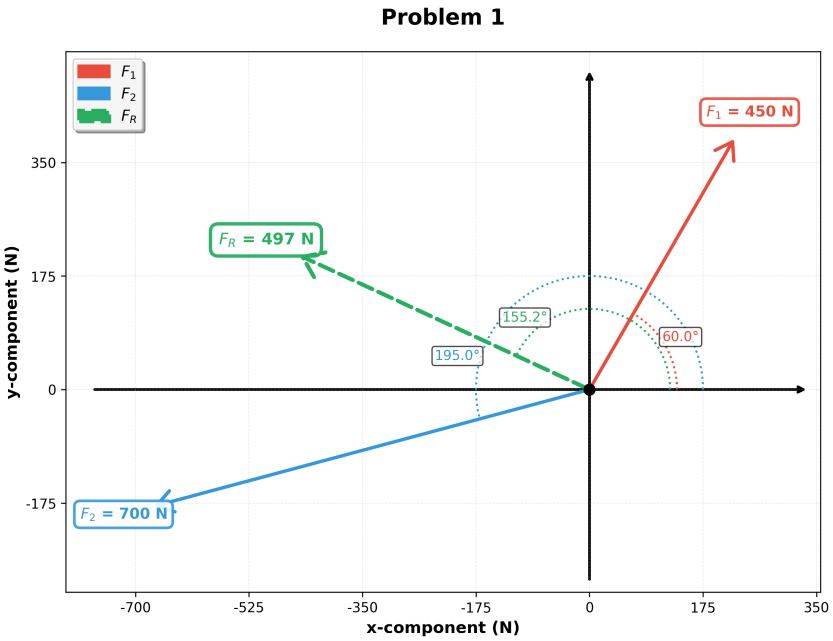

Figure: Vector diagram showing all forces and their orientations

Disclaimer

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