

Engineering Calculation Report: Problem 2-2: Find Force with Known Resultant

October 14, 2025

Description

If the resultant force is to be 500 N directed along the positive y-axis, and $F_2 = 700$ N at 195° , determine the magnitude and direction of F_1 .

1 Known Variables

Symbol	Magnitude (unit)		Angle ($^\circ$)
F_2	700	N	-165
F_R	500	N	90

2 Unknown Variables (To Calculate)

Symbol	Magnitude (unit)	Angle ($^\circ$)
F_1	?	?

3 Equations Used

1. $F_1^2 = F_R^2 + F_2^2 - 2 \cdot F_R \cdot F_2 \cdot \cos \theta_{F_R - \theta F_2}$
2. $\frac{\sin \alpha}{F_2} = \frac{\sin \gamma}{F_1}$

4 Step-by-Step Solution

Step 1: Solve for $F_{1Magnitude}$

Equation:

$$F_1^2 = F_R^2 + F_2^2 - 2 \cdot F_R \cdot F_2 \cdot \cos \theta_{F_R - \theta F_2}$$

Substitution:

$$F_1^2 = (500.00 \text{ N})^2 + (700.00 \text{ N})^2 - 2 \cdot (500.00 \text{ N}) \cdot (700.00 \text{ N}) \cdot \cos 105.0^\circ$$

Result:

$$F_{1Magnitude} = 959.78 \text{ N}$$

Step 2: Solve for $F_{1Direction}$

Equation:

$$\frac{\sin \alpha}{F_2} = \frac{\sin \gamma}{F_1}$$

Substitution:

$$\frac{\sin \alpha}{700.00 \text{ N}} = \frac{\sin 105.0^\circ}{959.78 \text{ N}}$$

Result:

$$F_{1Direction} = 45.21^\circ$$

5 Summary of Results

Variable	Name	Final Value	Unit
F_{1x}	$F_{1X} - \text{Component}$	676.148	N
F_{1y}	$F_{1Y} - \text{Component}$	681.173	N
F_{2x}	$F_{2X} - \text{Component}$	-676.148	N
F_{2y}	$F_{2Y} - \text{Component}$	-181.173	N
F_{Rmag}	$F_{RMagnitude}$	500	N
F_{Rangle}	$F_{RDirection}$	1.5708	°
F_{Rx}	$F_{RX} - \text{Component}$	3.06162×10^{-14}	N
F_{Ry}	$F_{RY} - \text{Component}$	500	N

6 Vector Diagram

Problem 2-2: Find Force with Known Resultant

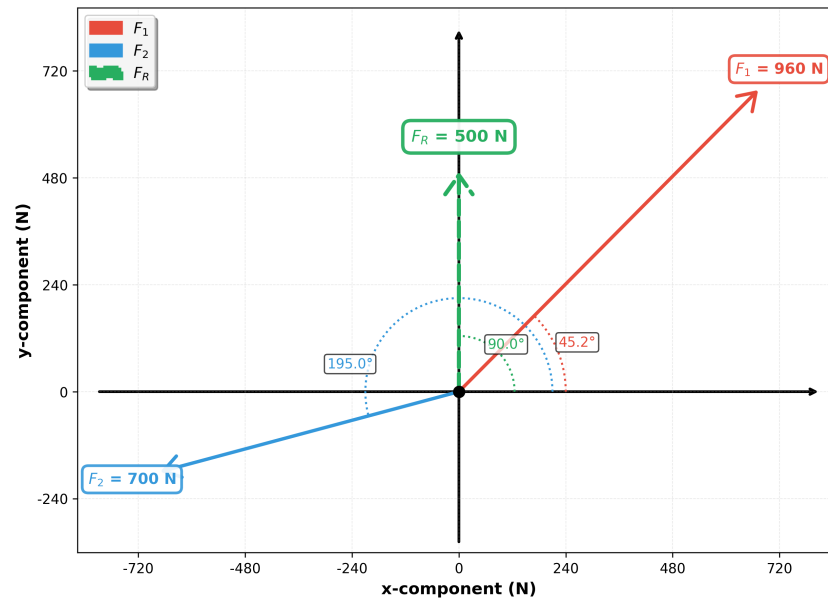


Figure: Vector diagram showing all forces and their orientations

Disclaimer

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