

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 (N) | Angle ($^\circ$) |
|--------|---------------|--------------------|
| F_2 | 700 | -165 |
| F_R | 500 | 90 |

2 Unknown Variables (To Calculate)

| Symbol | Magnitude (N) | 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. $\frac{\sin(\theta_{F_1})}{F_2} = \frac{\sin(\theta_{F_R} - \theta_{F_2})}{F_1}$

4 Step-by-Step Solution

Step 1: Solve for $|F_1|$

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:

$$|F_1| = 959.78 \text{ N}$$

Step 2: Solve for θ_{F_1}

Equation:

$$\frac{\sin(\theta_{F_1})}{F_2} = \frac{\sin(\theta_{F_R} - \theta_{F_2})}{F_1}$$

Substitution:

$$\frac{\sin(\theta_{F_1})}{700.00 \text{ N}} = \frac{\sin(105.0^\circ)}{959.78 \text{ N}}$$

Result:

$$\theta_{F_1} = 45.21^\circ$$

5 Summary of Results

| Symbol | Magnitude (N) | Angle ($^\circ$) | F_x (N) | F_y (N) |
|--------|---------------|--------------------|---------------------------|-----------|
| F_1 | 959.778 | 45.2121 | 676.148 | 681.173 |
| F_2 | 700 | -165 | -676.148 | -181.173 |
| F_R | 500 | 90 | 3.06162×10^{-14} | 500 |

Disclaimer

IMPORTANT NOTICE:

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