Course Code: ESC106A
Course Title: Construction Materials and Engineering Mechanics

Lecture No. 13:
Problems on Coplanar Concurrent Force Systems

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Lecture Intended Learning Outcomes

At the end of this lecture, students will be able to:

- Apply the method of resolution and find the resultant of coplanar concurrent force system

- Solve for the unknown forces given the resultant of concurrent force system

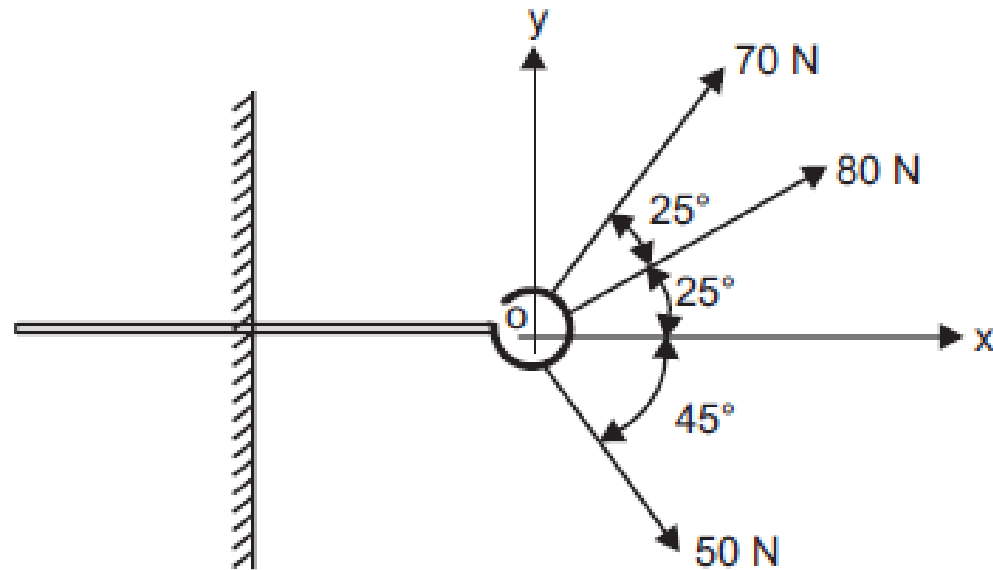- Calculate the angles of applied forces given the resultant of concurrent force system

Contents

- **Analysis of Coplanar Concurrent and Non-Concurrent System of Forces**

Resultant of Concurrent force systems by method of Resolution-Numerical problems

Example Problem

Determine the resultant of the three forces acting on a hook as shown in Figure.

Example Problem

Solution:

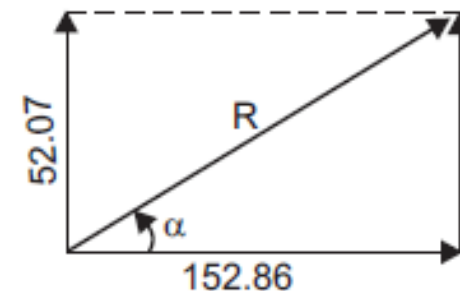| Force	x component	y component
70 N	45.00	53.62
80 N	72.50	33.81
50 N	35.36	–35.36
	$R_x = \Sigma F_x = 152.86,$	$R_y = \Sigma F_y = 52.07$

$$R = \sqrt{152.86^2 + 52.07^2}$$

$$R = 161.48 \text{ N}$$
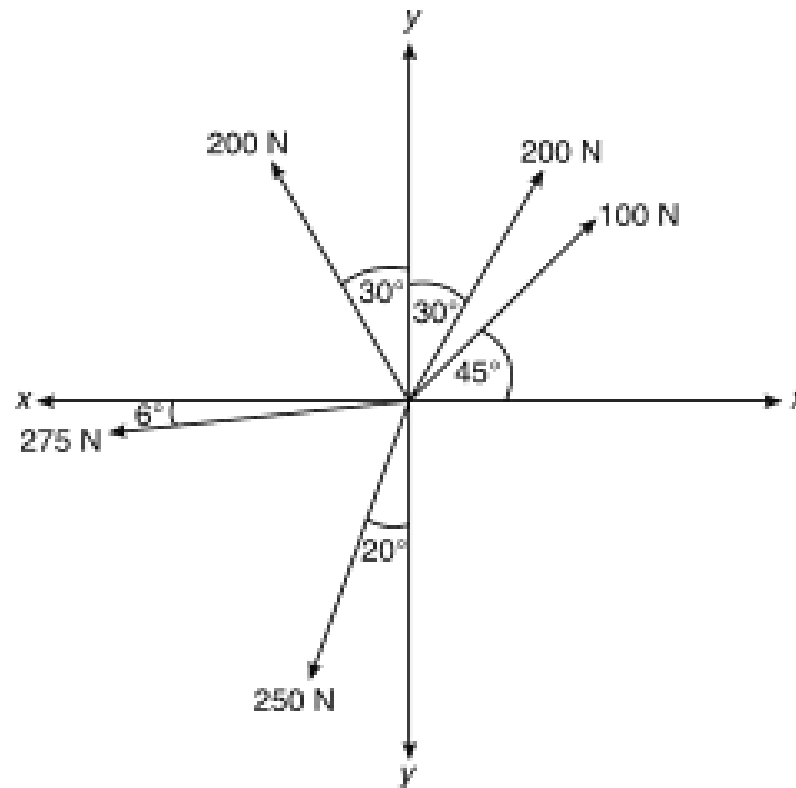
$$\alpha = \tan^{-1} \frac{52.07}{152.86}$$

$$\alpha = 18.81°$$

Problems

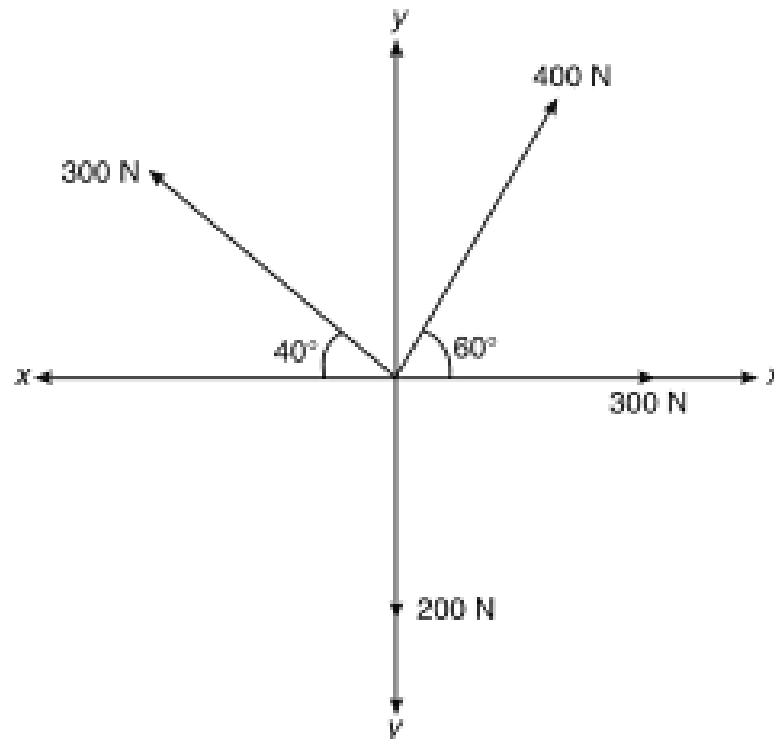1.Find the resultant of coplanar concurrent force system shown in the figure

R=326.58N

Problems

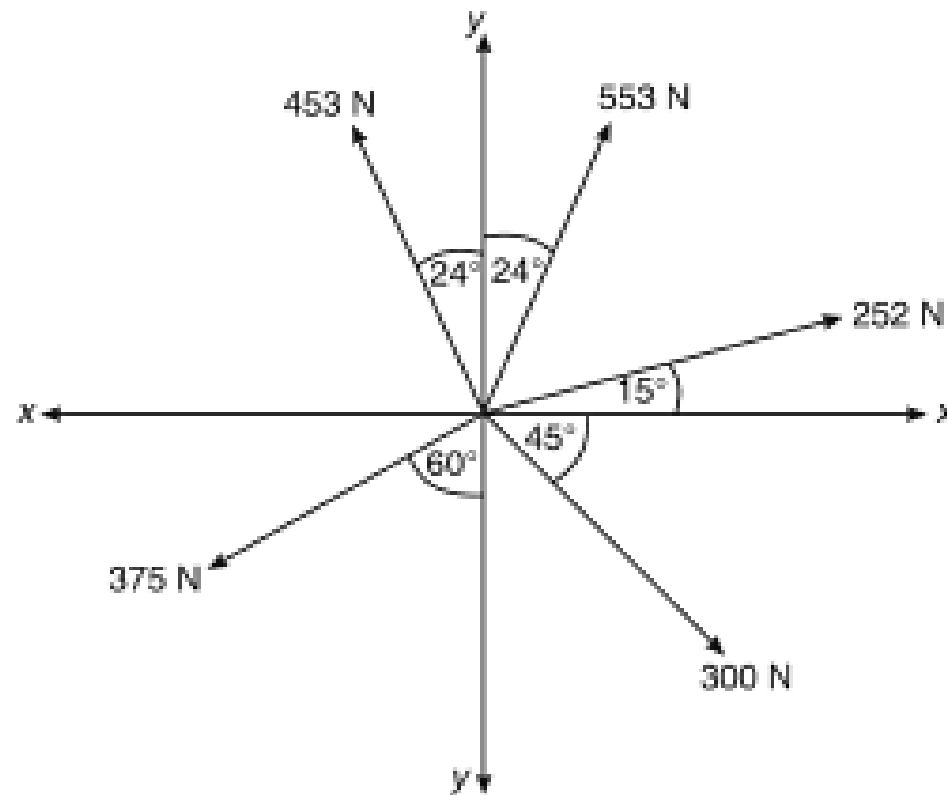2.Find the resultant of coplanar concurrent force system shown in the figure

R=433.69N

Problems

3. Find the resultant of coplanar concurrent force system shown in the figure

R=609.24N
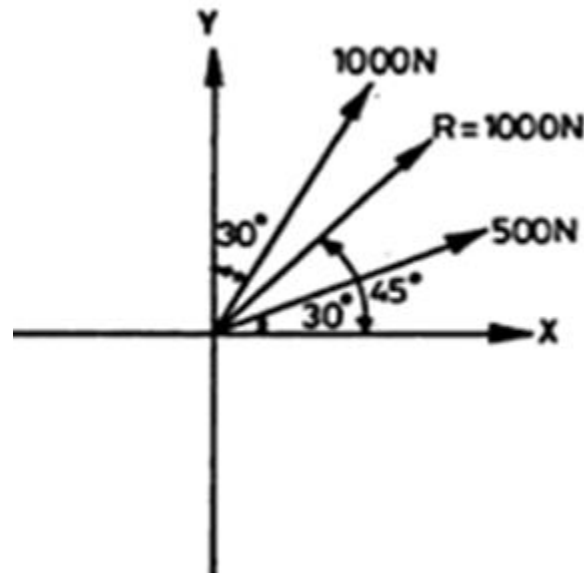
Θ = 73.65⁰

Problems

5.Two forces acting on a body are 500N and 1000N as shown in figure Determine the third force F such that the resultant of all the three forces is 1000N directed at 45^0 to the x-axis

F=-467.2N

Problems

6.Three forces acting at a point are shown in figure. The direction of the 300 N forces may vary , but the angle between them is always 40^0. Determine the value of θ for which the resultant of the three forces is directed parallel to the plane.
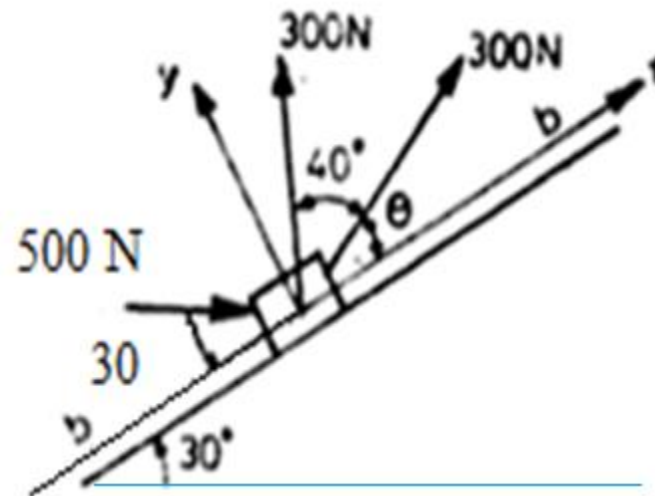
Problems

Solution for Problem 6

$$R = \sum F_x \; ; \sum F_y = 0$$

$$-500sin30 + 300\sin(40 + \theta) + 300sin\theta = 0$$

$$300[\sin(40 + \theta) + sin\theta] = 500sin30$$

$$\sin(40 + \theta) + sin\theta = 0.833$$

$$2sin\left(\frac{40 + \theta + \theta}{2}\right) cos\left(\frac{40 + \theta - \theta}{2}\right) = 0.833$$

$$2sin(20 + \theta)cos20 = 0.833$$

$$(20 + \theta) = 0.443$$

$$\theta = 6.32°$$

Summary

- The concept of the resultant of Coplanar Concurrent force system is applied for solving the problems

- Unknown forces can be evaluated from the resultant of a concurrent force system