

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

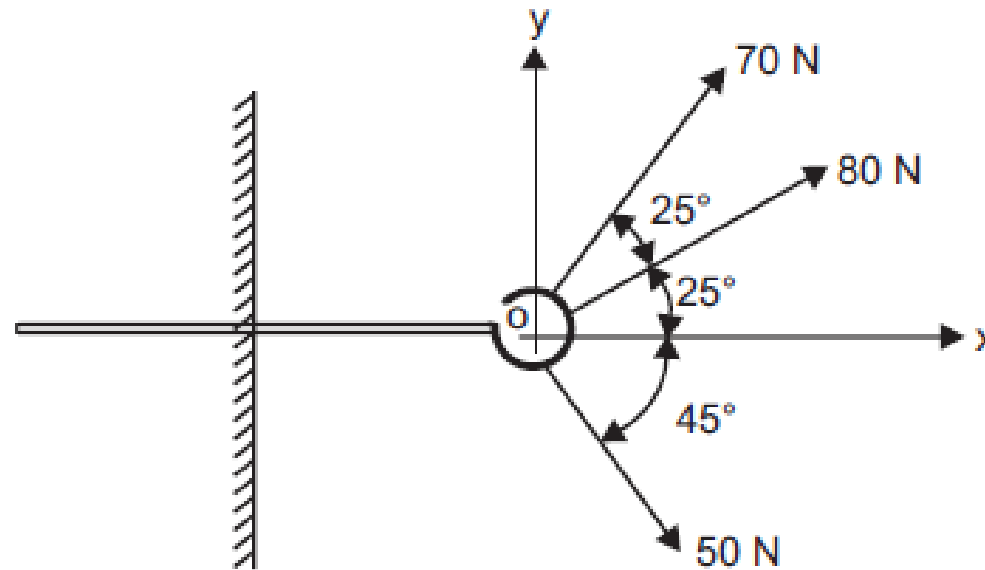
- **Analysis of Coplanar Concurrent and Non-Concurrent System of Forces**

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

$$R_x = \Sigma F_x = 152.86,$$

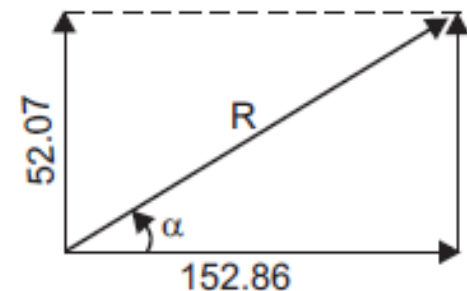
$$R_y = \Sigma F_y = 52.07$$

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

$$R = 161.48 \text{ N}$$

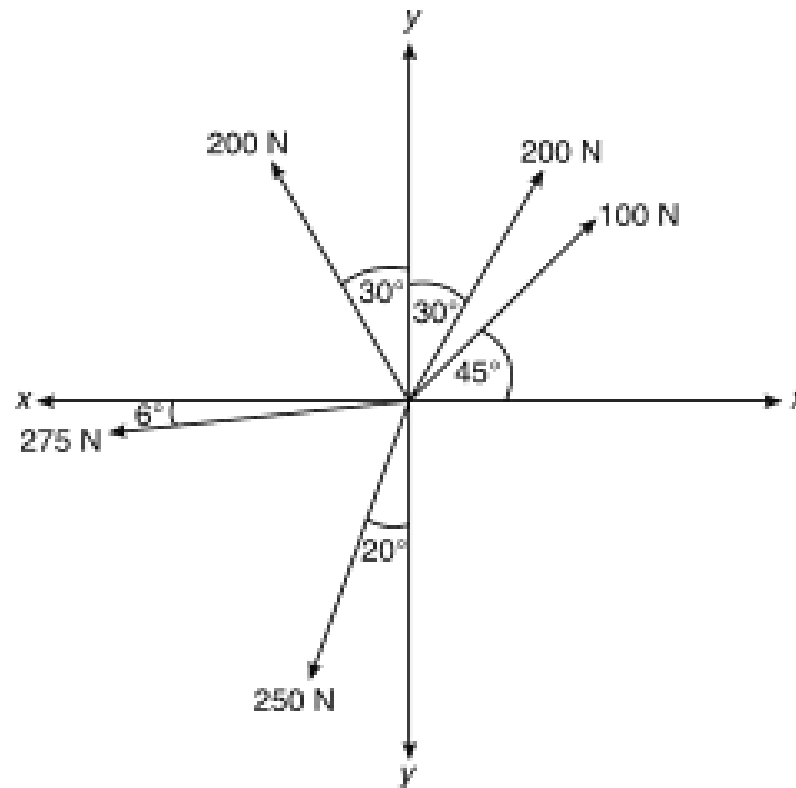
$$\alpha = \tan^{-1} \frac{52.07}{152.86}$$

$$\alpha = 18.81^\circ$$



Problems

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

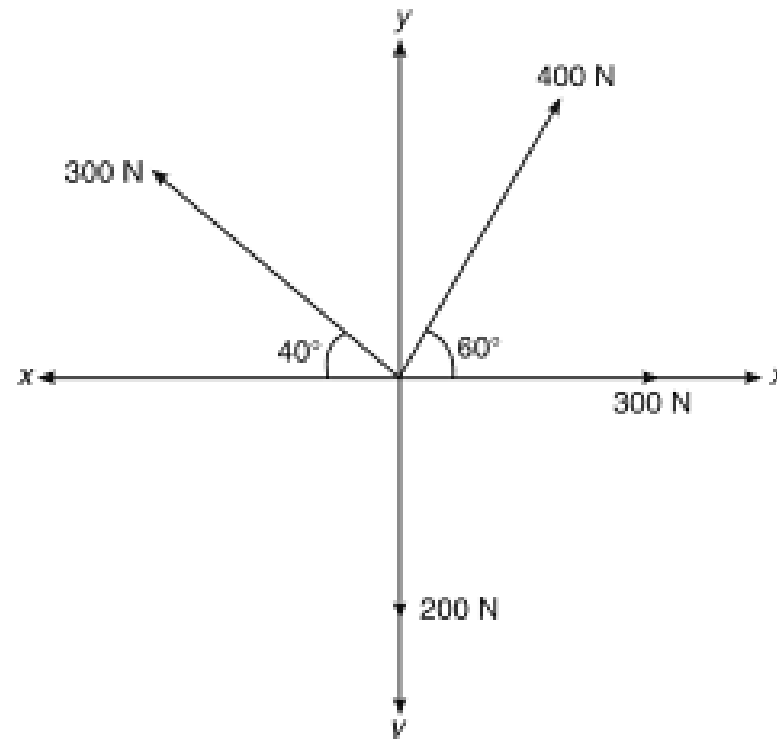


$$R = 326.58 \text{ N}$$



Problems

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

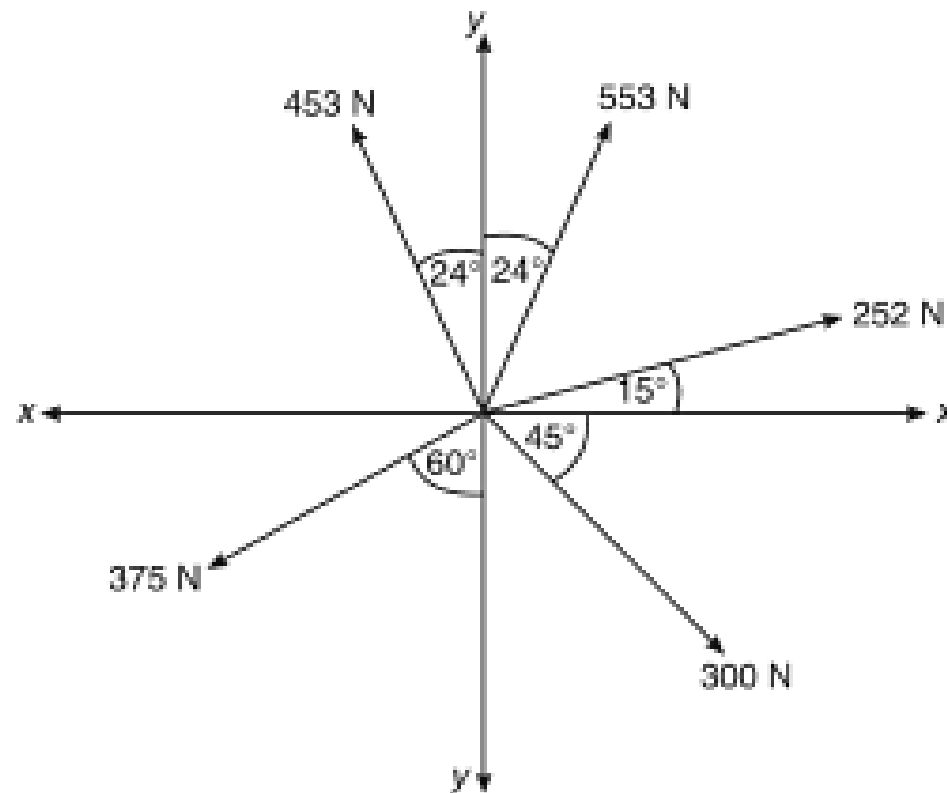


$$R = 433.69 \text{ N}$$



Problems

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



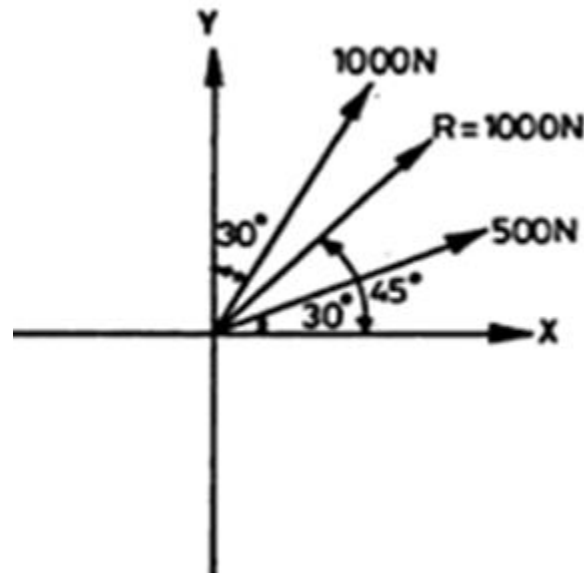
$$R = 609.24 \text{ N}$$

$$\theta = 73.65^\circ$$



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° to the x-axis.

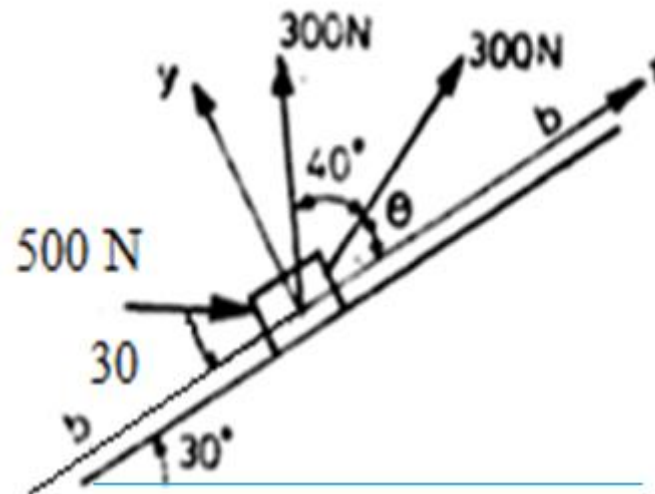


$$F = -467.2N$$



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° . Determine the value of θ for which the resultant of the three forces is directed parallel to the plane.



Problems

Solution for Problem 6

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

$$-500\sin 30 + 300 \sin(40 + \theta) + 300\sin\theta = 0$$

$$300[\sin(40 + \theta) + \sin\theta] = 500\sin 30$$

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

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

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

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

$$\theta = 6.32^\circ$$



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

