

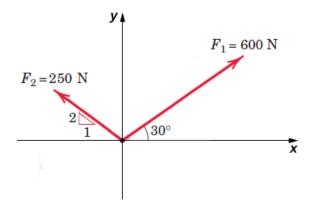
Al-Mustaqbal University / College of Engineering & Technology Department (Building and Construction Techniques Engineering) Class (1st)

Subject (Mechanics) / Code (UOMU023011) Lecturer (Dr. Mayadah W. Falah)

1st/2nd term – Lecture No. & Lecture Name (Lec.No.3 Composition & Resolution of Fore

Example No. 2: For the force system shown in figure:

- **a.** Find the vertical and horizontal component of each force.
- **b.** Determine the resultant and its direction.



Solution:

a.

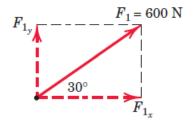
$$F_{1x} = F_1 \cos 30 = 600 \cos 30 = 519.615 N \rightarrow$$

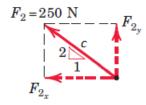
$$F_{1y} = F_1 \sin 30 = 600 \sin 30 = 300 N$$
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$$c = \sqrt{1^2 + 2^2} = \sqrt{5}$$

$$F_{2x} = F_2 \frac{1}{\sqrt{5}} = 250 \times \frac{1}{\sqrt{5}} = 111.803 N \leftarrow$$

$$F_{2y} = F_2 \frac{2}{\sqrt{5}} = 250 \times \frac{2}{\sqrt{5}} = 223.607 \, N \uparrow$$





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$$\alpha = \tan^{-1}\left(\frac{2}{1}\right) = 63.435^{\circ}$$

$$\theta = 63.435 + 30 = 93.435^{\circ}$$

To find the value of resultant:

$$R = \sqrt{{F_1}^2 + {F_2}^2 - 2F_1F_2\cos\theta}$$

$$R = \sqrt{600^2 + 250^2 - 2 \times 600 \times 250 \times \cos 93.435} = 663.683 \, N$$

To find the direction of resultant:

$$\frac{R}{\sin \theta} = \frac{F_2}{\sin \beta}$$

$$\frac{663.683}{\sin 93.435} = \frac{250}{\sin \beta} \quad \to \quad \sin \beta = \frac{250 \times \sin 93.435}{663.683} = 0.376$$

$$\beta = \sin^{-1} 0.376 = 22.086^{\circ}$$

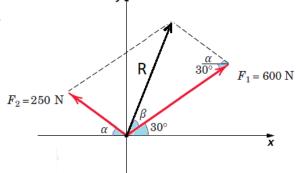
The direction of R from the horizontal axis = $30 + 22.086 = 52.086^{\circ}$

$$R = 663.683 N$$

$$52.086^{\circ}$$

Example No. 3: A force P = 800 N is shown in Figure.

- **a.** Find the components of P with respect to x and y axis.
- **b.** Find the components of P with respect to x' and y' axis.

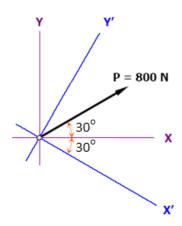




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Solution:

Part (a): The components of P with respect to x and y axis

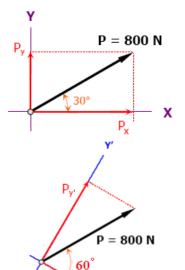
$$P_x = P \cos 30 = 800 \cos 30 = 692.82 \, N \rightarrow$$

$$P_y = P \sin 30 = 800 \sin 30 = 400 N$$
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Part (b): The components of P with respect to x' and y' axis

$$P_{\dot{x}} = P\cos 60 = 800\cos 60 = 400 \, N$$

$$P_{y} = P \sin 60 = 800 \sin 60 = 692.82 \, N$$





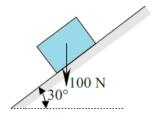
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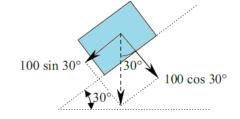
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Example No. 4: Resolve weight [100 N] in two rectangular components parallel and normal to the inclined surface.



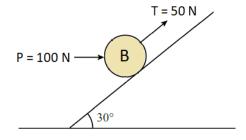
Solution:

$$W_{\text{normal}} = 100 \cos 30 = 86.6 \, N$$
 $W_{\text{parallel}} = 100 \sin 30 = 50 \, N$



Problems:

- 1. A ball (B) is stopped on inclined surface 30° with horizontal by a horizontal force p = 100 N.
- a. Resolve the force P in two rectangular components parallel and normal to the inclined surface.
- b. If another force T = 50 N pull the ball in direction parallel to the inclined surface, replace this pair of forces by single force.



Answer: **a**)
$$P_{\hat{x}} = 86.603 \, N$$
, $P_{\hat{y}} = 50 \, N$,

b)
$$R = 145.466 \, N$$

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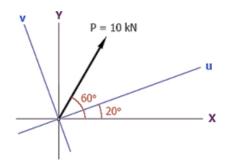


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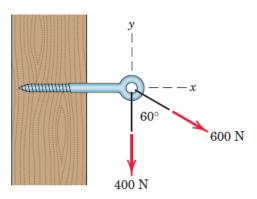
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2. Find the components in the x, y, u and v directions of the force P = 10 kN shown in Fig.



Answer:
$$P_x = 5 kN \rightarrow$$
, $P_y = 8.660 kN \uparrow$, $P_u = 7.660 kN \nearrow$, $P_v = 6.428 kN \uparrow$,

3. Determine the resultant \mathbf{R} of the two forces shown by applying the parallelogram rule.



Answer: R = 871.780 N

