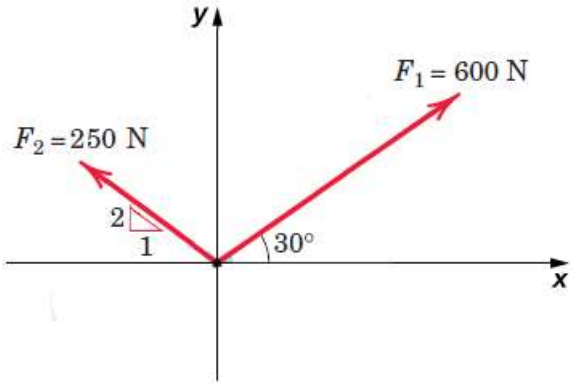
Example No. 2: For the force system shown in figure:

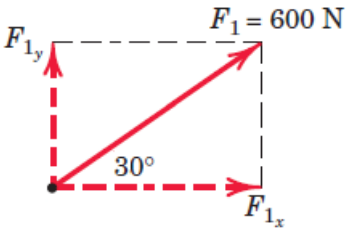
a. Find the vertical and horizontal component of each force.

b. Determine the resultant and its direction.



Solution:

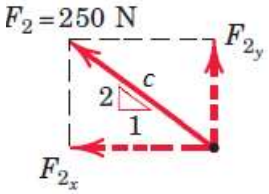
a.



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

$$F_{1y} = F_1 \sin 30 = 600 \sin 30 = 300\ N \quad \uparrow$$

$$c = \sqrt{1^2 + 2^2} = \sqrt{5}$$



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

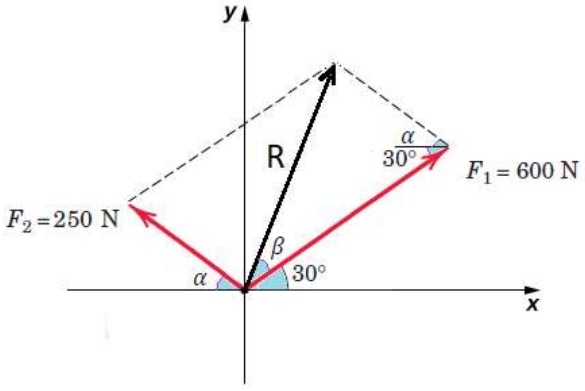
$$F_{2y} = F_2 \frac{2}{\sqrt{5}} = 250 \times \frac{2}{\sqrt{5}} = 223.607\ N \quad \uparrow$$

b.

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

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

To find the value of resultant**:**



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

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

Dr. Mohammed Zuhair
Dr. Mayadah W. Falah

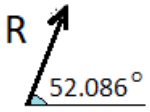
To find the direction of resultant:

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

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

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

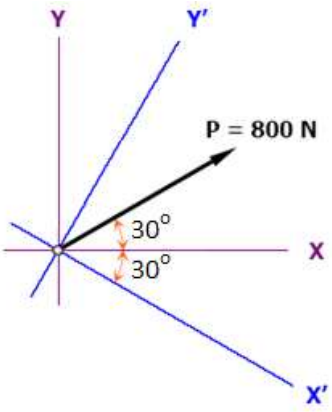
The direction of R from the horizontal axis $= 30 + 22.086 = 52.086^{\circ}$

$\therefore R = 663.683\ N$ 

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.

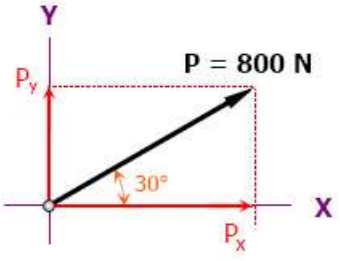


Solution:

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

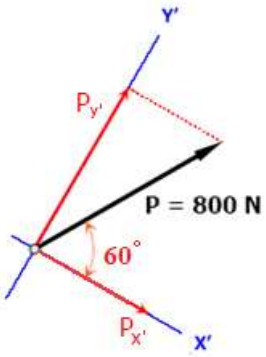
$$P_x = P\cos 30 = 800\cos 30 = 692.82\ N \quad \rightarrow$$

$$P_y = P\sin 30 = 800\sin 30 = 400\ N \quad \uparrow$$



Dr.Mohammed Zuhair
Dr. Mayadah W. Falah

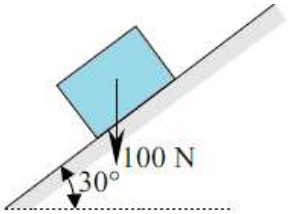
Part (b): The components of P with respect to x' and y' axis



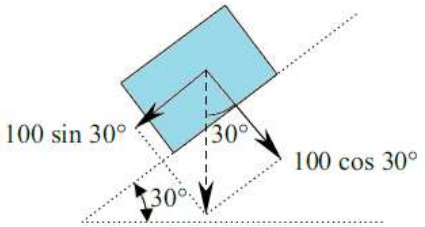
$$P_{\dot{x}} = P\cos 60 = 800\cos 60 = 400\ N \quad \searrow$$

$$P_{\dot{y}} = P\ sin\ 60 = 800\ sin\ 60 = 692.82\ N \quad \nearrow$$

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



Solution:



$$W_{\text{normal}} = 100\cos 30 = 86.6\ N \quad \searrow$$

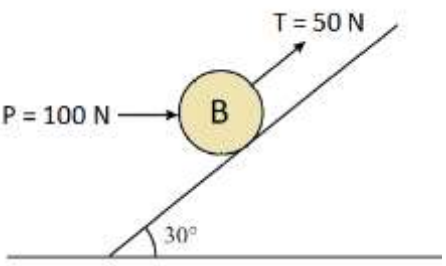
$$W_{\text{parallel}} = 100\sin 30 = 50\ N \quad \swarrow$$

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.

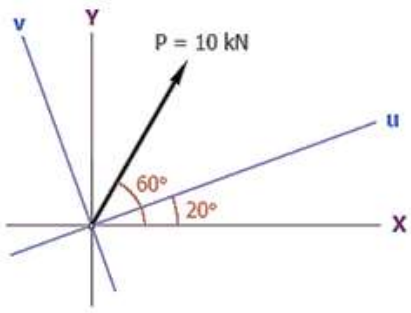
b. If another force T = 50 N pull the ball in direction parallel to the inclined surface, replace this pair of forces by single force.



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

b) $R = 145.466\ N$ 9.904°

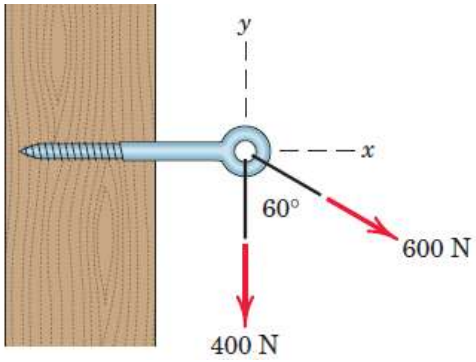
2. Find the components in the x, y, u and v directions of the force P = 10 kN shown in Fig.



Answer: $P_x = 5\ kN \rightarrow$, $P_y = 8.660\ kN \uparrow$,

$P_u = 7.660\ kN \nearrow$, $P_v = 6.428\ kN \nwarrow$,

3. Determine the resultant **R** of the two forces shown by applying the parallelogram rule.



Answer: $R = 871.780\ N$ 36.587°

Dr. Mohammed Zuhair
Dr. Mayadah W. Falah