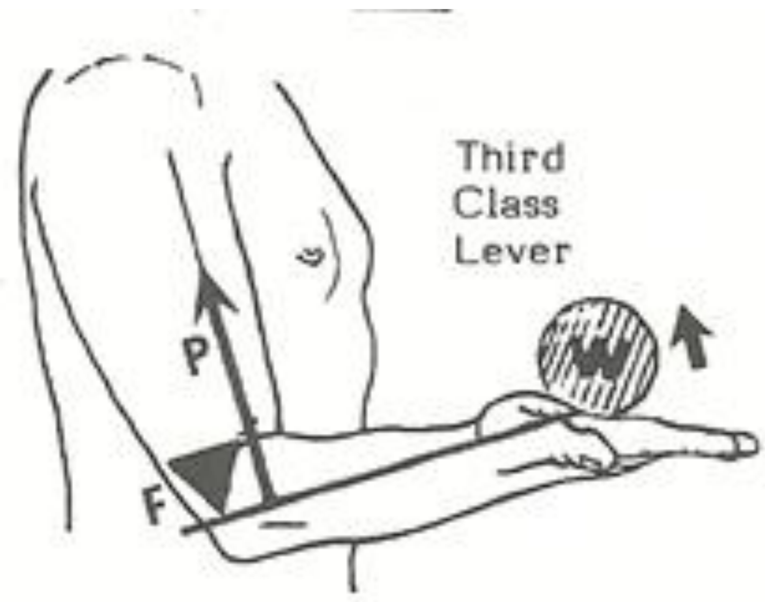
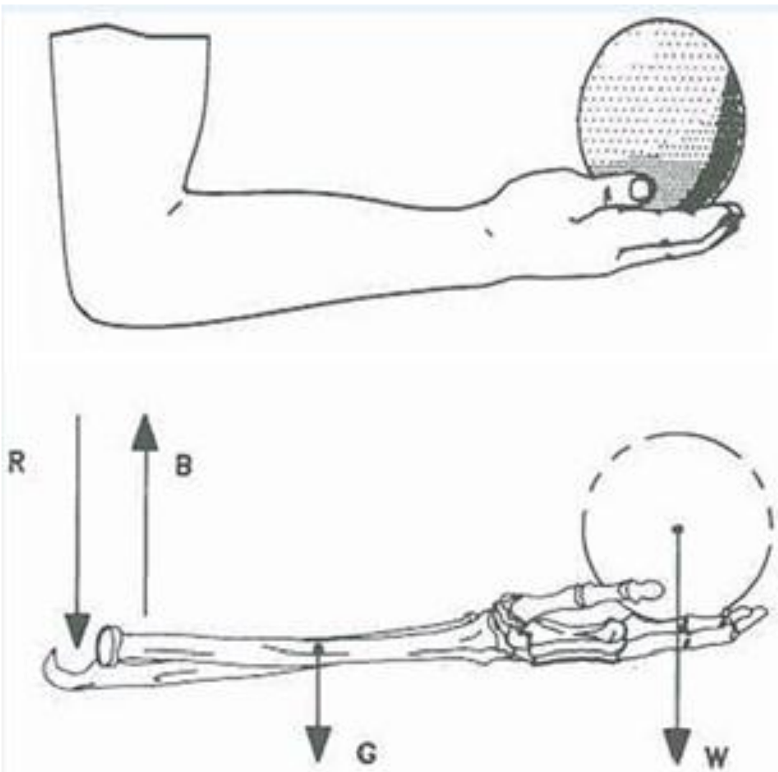
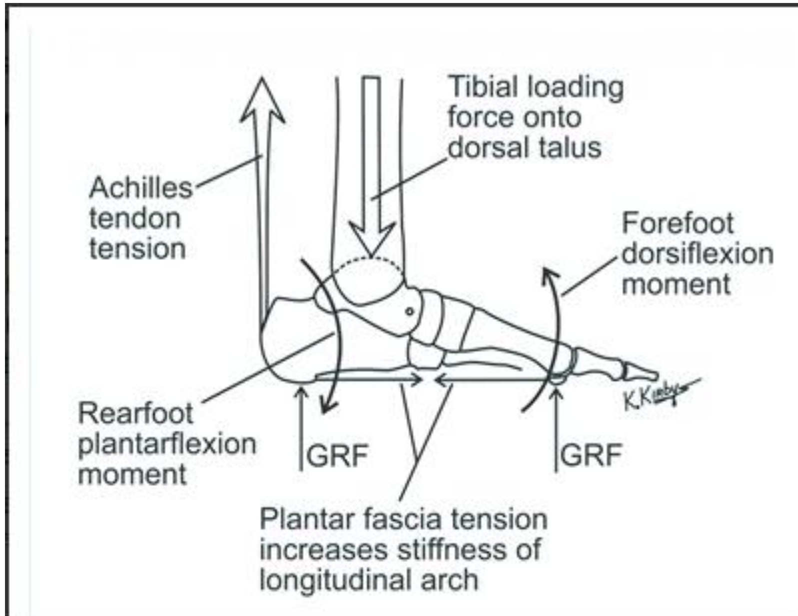
Force System

1. External Force
2. Internal Force



Concentrated Force
Distributed Force

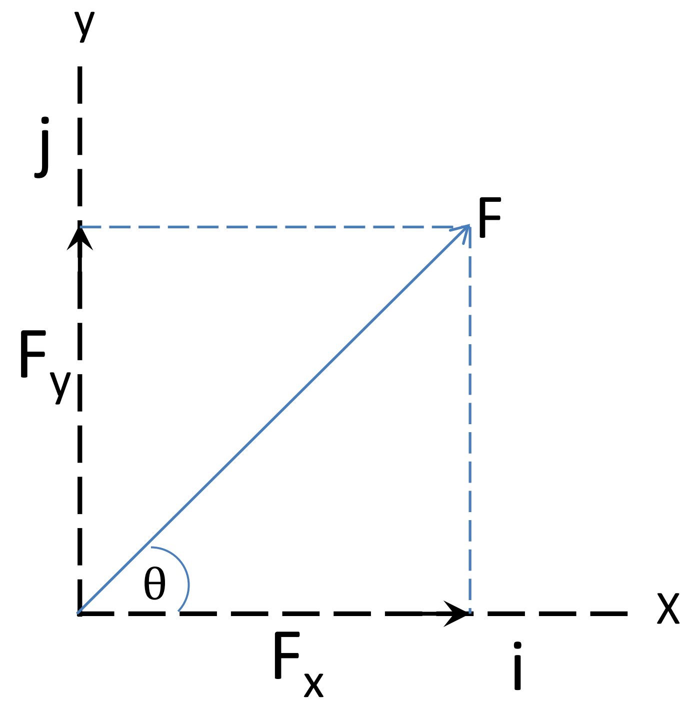


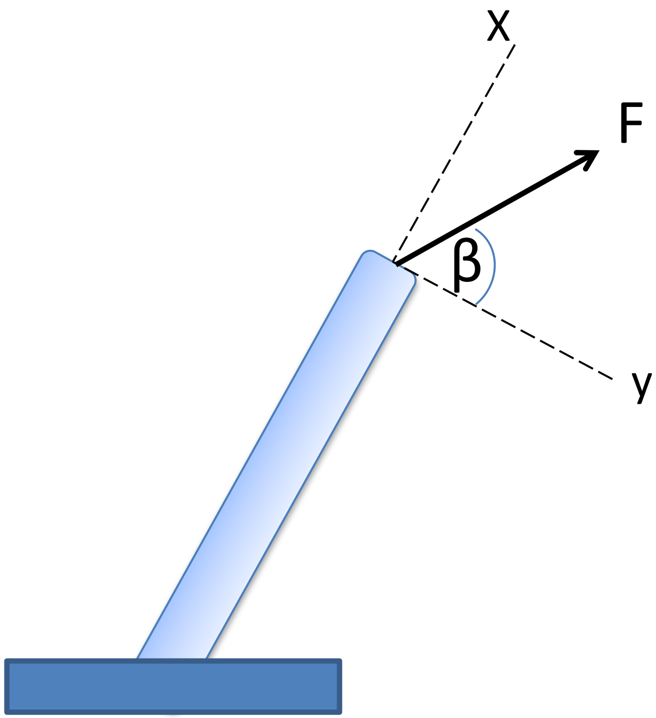


In modern biomechanical terminology, the plantar fascia stiffens the medial and lateral arches of the foot so that vertical loading forces on the foot produce only a slight amount of longitudinal arch deformation as long as the plantar fascia is intact.

Two Dimension Force System

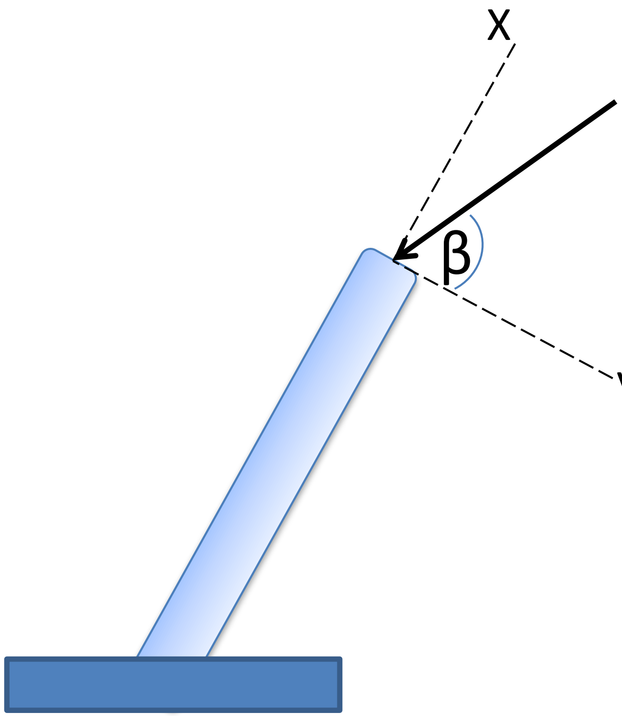
- $F = F_x i + F_y j$
- $F_x = F \cos\theta$
- $F_y = F \sin\theta$
- $F = \sqrt{Fx^2 + Fy^2}$
- $\theta = \tan^{-1} Fx/Fy$





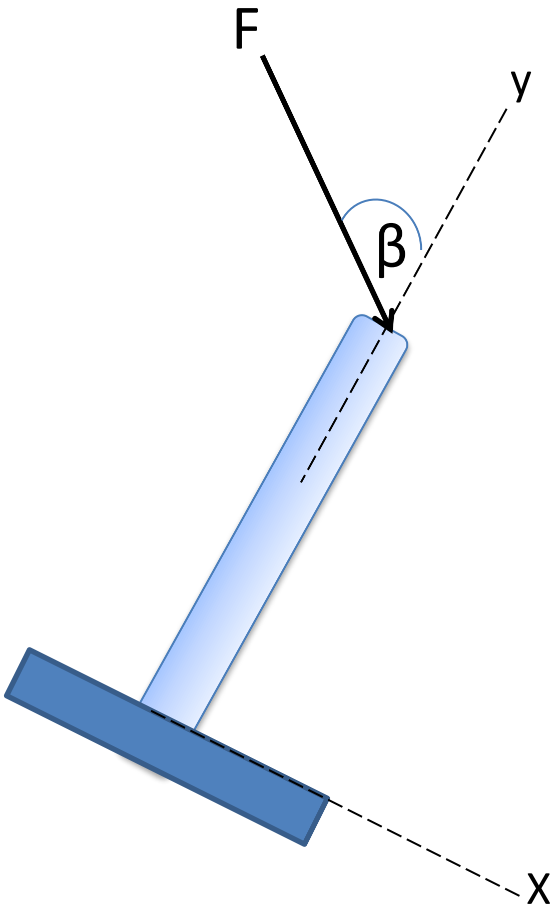
$F_x = F\ sin\ \beta$

$F_y = F\ cos\beta$



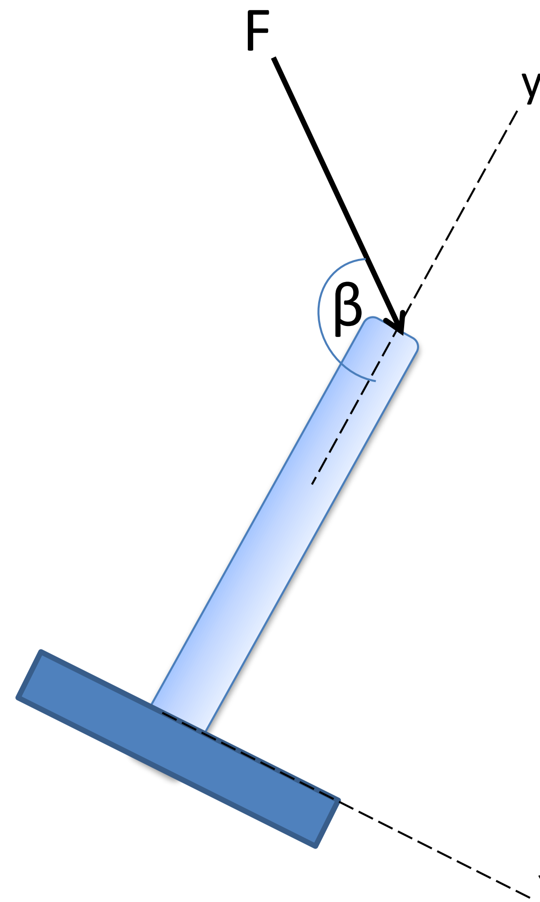
$F_x = -\ F\ sin\ \beta$

$F_y = -\ F\ cos\beta$



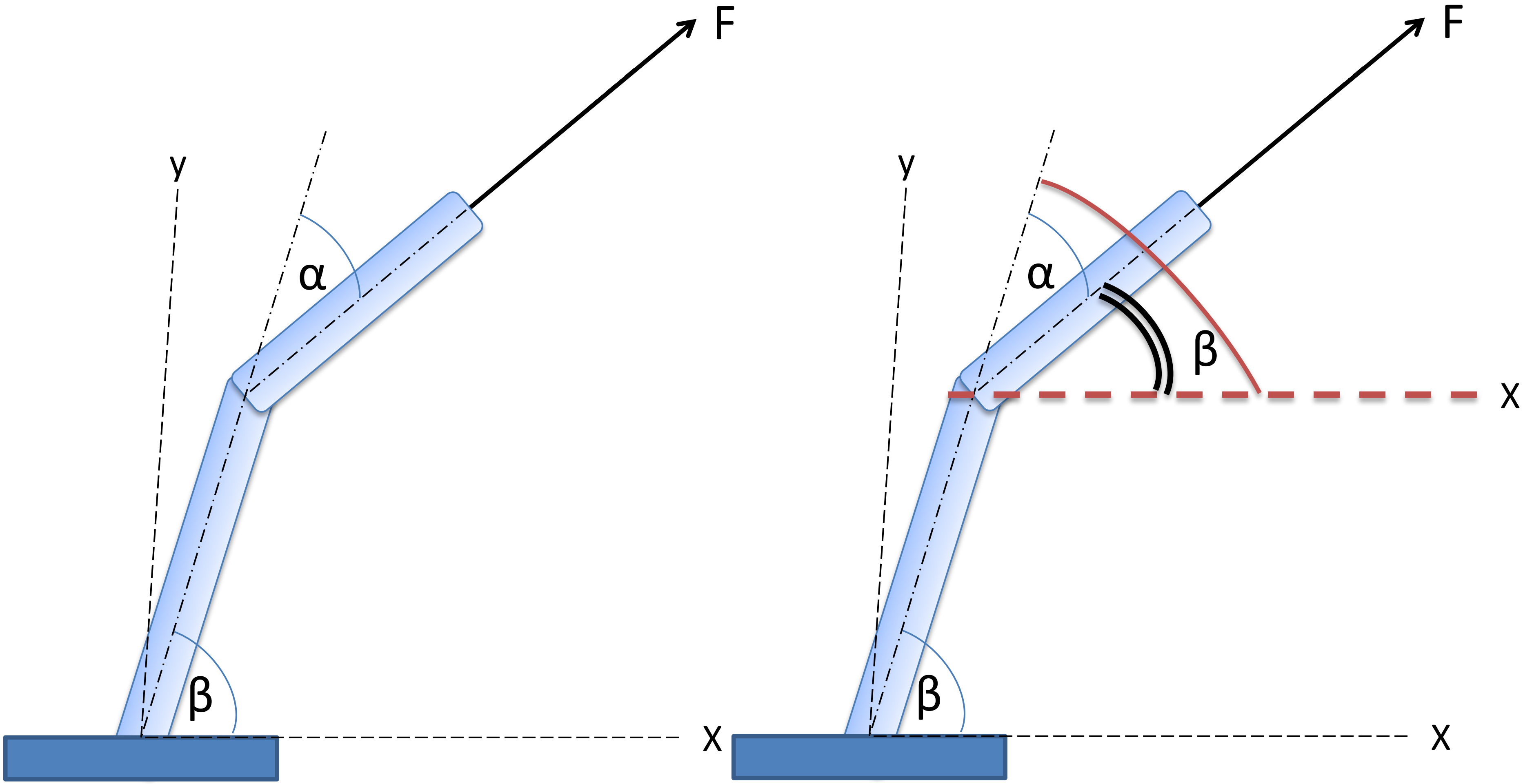
$F_x = F\,sin\,\beta$

$F_y = -F\,cos\beta$



$F_x = F\,sin(180 - \beta)$

$F_y = -F\,cos(180 - \beta)$



$$F_x = F\cos(\beta - \alpha)$$
$$F_y = F\sin(\beta - \alpha)$$

Determine the x and y scalar component of each of three forces.

$F_{1x} = 600 \cos 35^\circ = 491\ \text{N}$

$F_{1y} = 600 \sin 35^\circ = 344\ \text{N}$

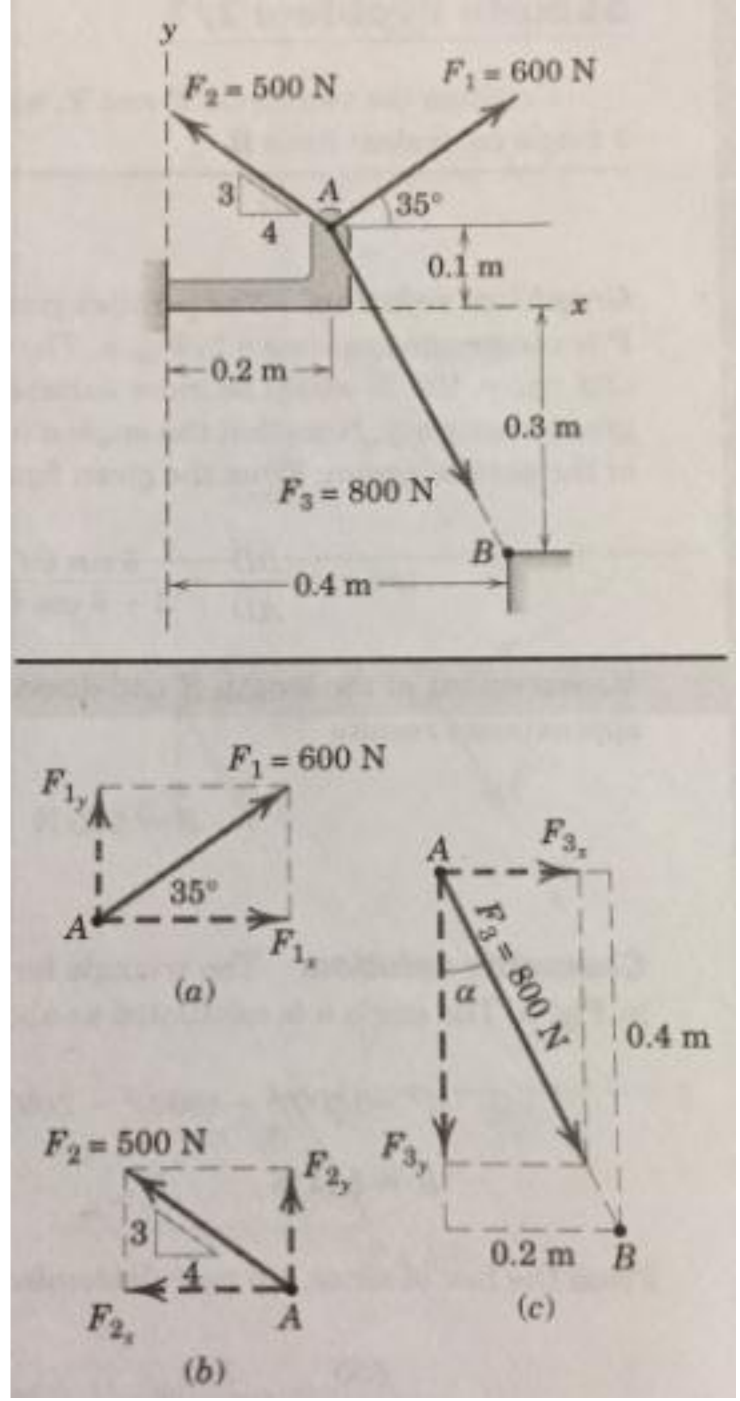
$F_{2x} = -500\ (\frac{4}{5}) = -400\ \text{N}$

$F_{2y} = 500\ (\frac{3}{5}) = 300\ \text{N}$

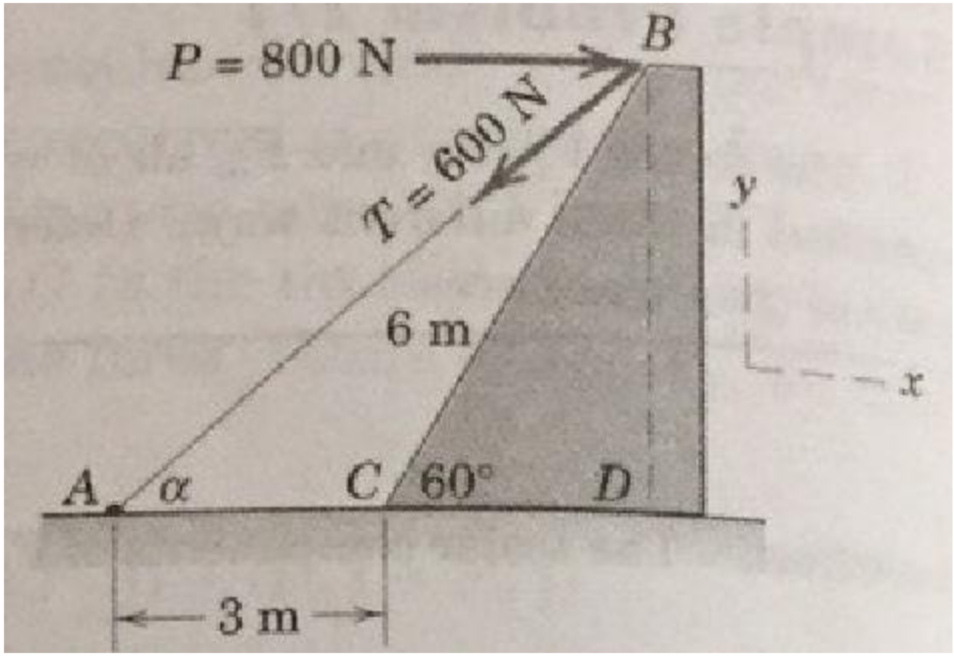
$\alpha = \tan^{-1}\frac{0.2}{0.4} = 26.6^\circ$

$F_{3x} = 800 \sin 26.6^\circ = 358\ \text{N}$

$F_{3y} = -800 \cos 26.6^\circ = -716\ \text{N}$



Combine the two forces P and T into a single equivalent force R



R= $\sqrt{Rx^2 + Ry^2}$

Rx = $\sum Fx$

Ry= $\sum Fy$

Rx = 800 – 600 cos α

Ry = -600 sin α

$$\tan\alpha = \frac{BD}{AD} = \frac{6\sin 60}{3 + 6\cos 60}$$

$$= 0.866$$

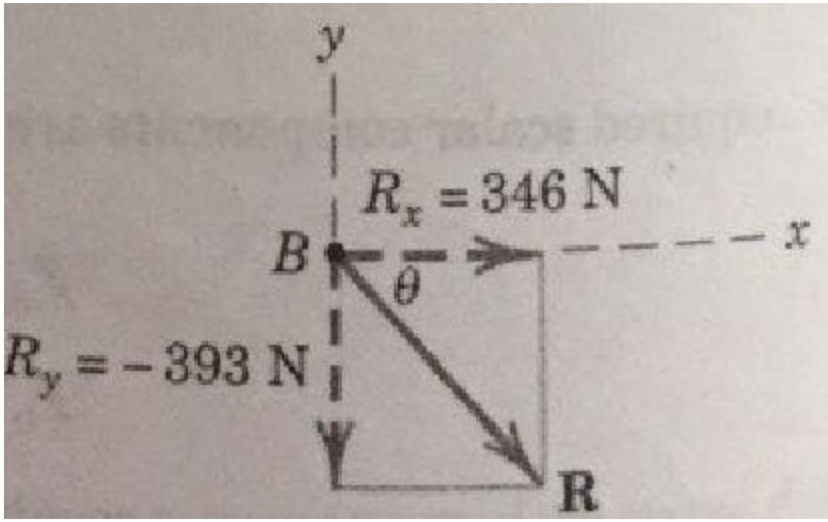
$$\alpha = 40.9$$

Rx = 346 N

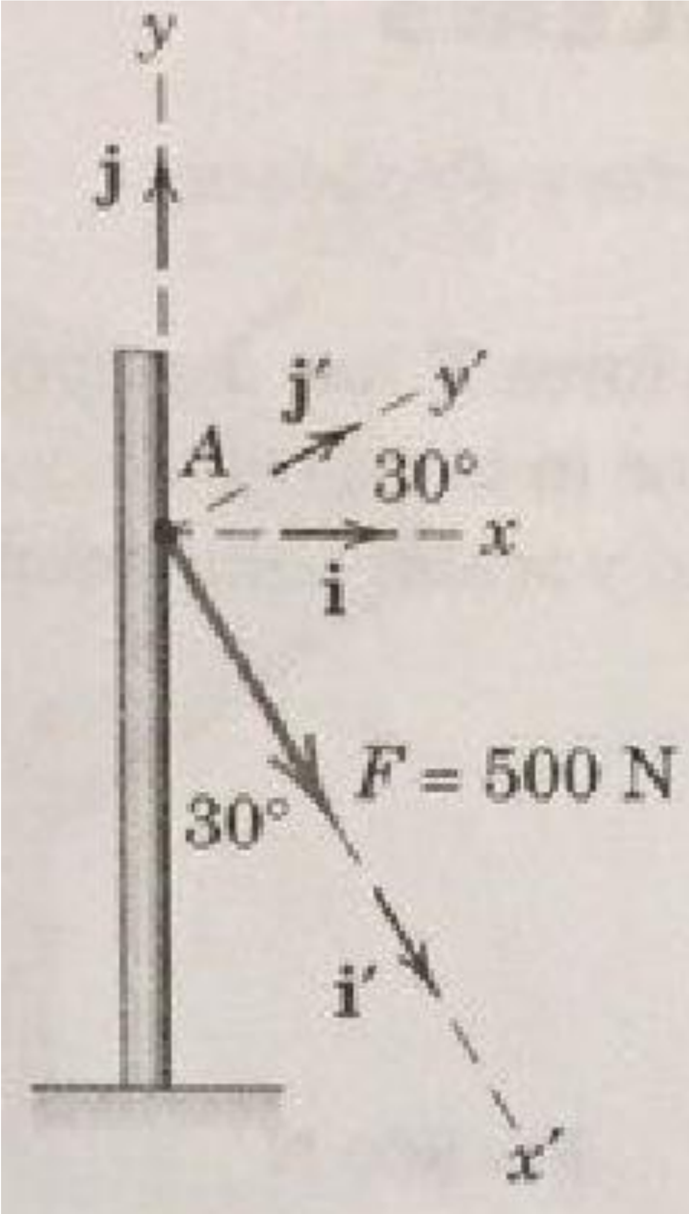
Ry = - 393 N

R = 524 N

θ = $\tan^{-1}\frac{|Ry|}{|Rx|}$ = $tan^{-1}\frac{|-393|}{|346|}$ = 48.6



The force F is applied at the pole as shown. (1) Write F in terms of the unit vector i and j and identify both its vector and scalar components. **(2) Determine the scalar components of F along the x^- and y^- - axes.** (3) Determine the scalar components of F along the x- and y^- axes.



Solution:

(1) $F = (F \cos \theta)i - (F \sin \theta)j$

$= 500 \cos 60\, i - 500 \sin 60\, j$

$= (250i - 433j)$ N

The scalar components

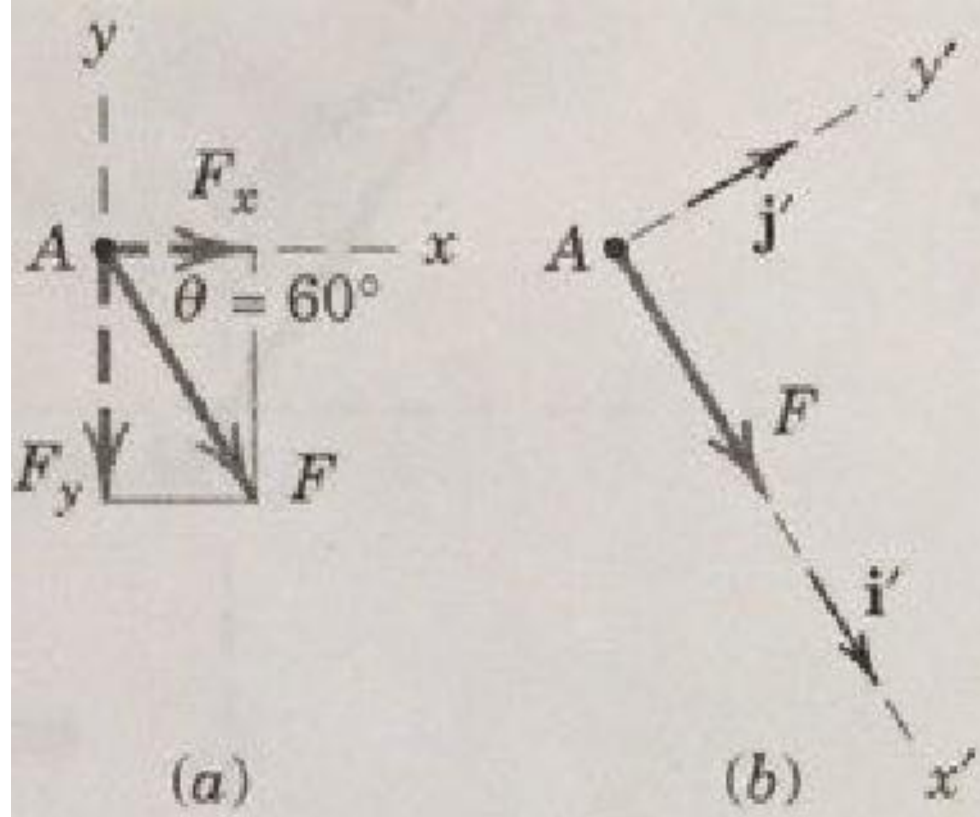
F_x= 250 N ; F_y= -433 N

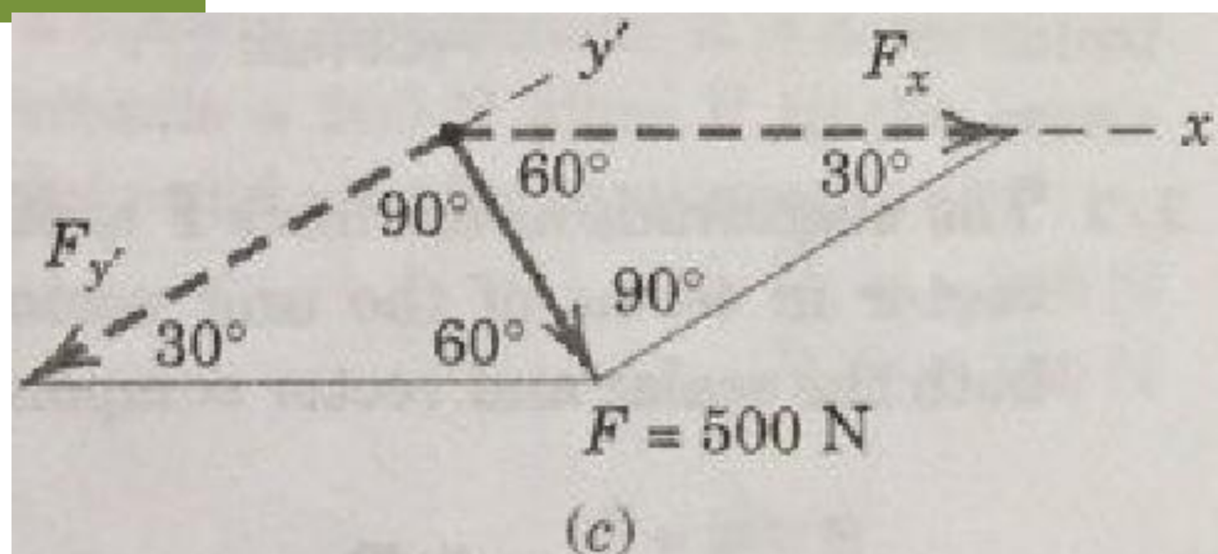
(2) $F_{\bar{x}}$ = 500 N ; $F_{\bar{y}}$= 0

(3) The components of F along the x- and $\bar{y}$ axes are nonrectangular

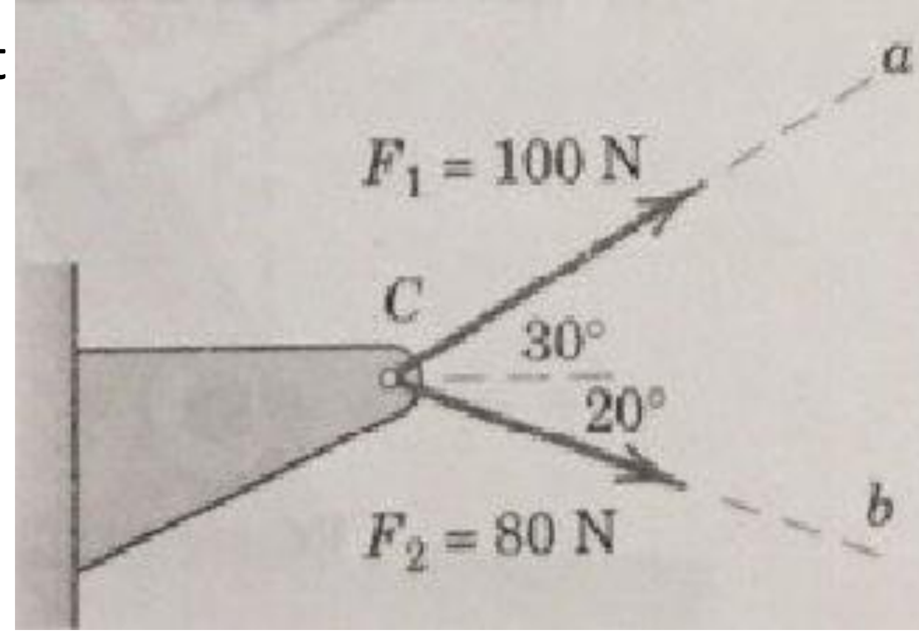
$\frac{Fx}{\sin 90} = \frac{500}{\sin 30}$; Fx= 1000 N

$\frac{Fy\prime}{\sin 60} = \frac{500}{\sin 30}$ $F_{\bar{y}}$ = 866 N





Forces F1 and F2 acts on the bracket as shown. Determine the projection F_b of their resultant **R** onto the b-axes.



Solution

$R^2 = 80^2 + 100^2 - 2(80)(100)\cos 130 = 163.4$ N

$F_b = 80 + 100\cos 50 = 144.3$ N