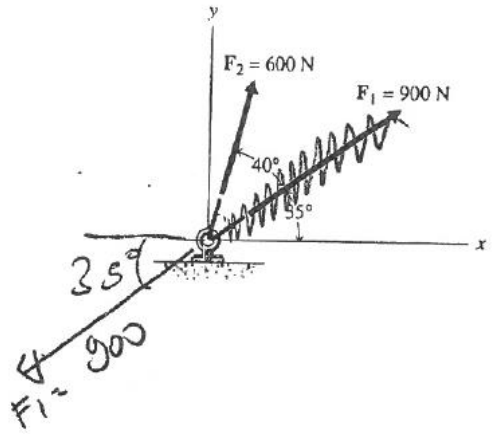
10/15/2020

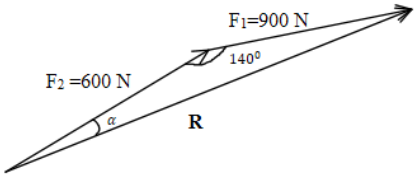
ES 221 MECHANICS I (STATICS) RECITATION I

Q1)



Two forces are applied to an eye bracket as shown in the figure above. Determine F_2-F_1= **R** and the angle θ between the axis and the line of action of the resultant.

Answer to Q1



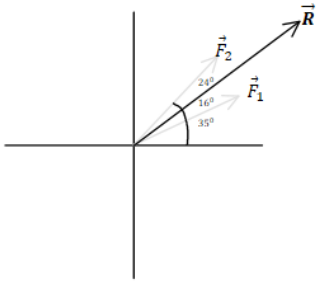
$\vec{F}_2 - \vec{F}_1 = \vec{F}_2 + (-\vec{F}_1)$

$R^2 = 600^2 + 900^2 - 2 \times 600 \times 900 \times cos140$

R = 1413 N

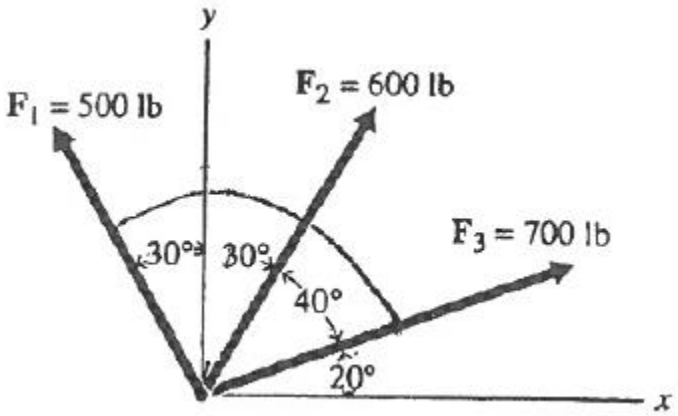
From the law of sines:

$\frac{1413\ N}{\sin 140^0} = \frac{900\ N}{sin\alpha}$ $\alpha = 24^0$



$\theta = 16^0 + 35^0 = 51^0$

Q2)



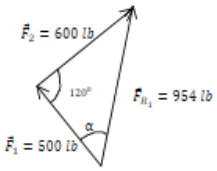
Determine the magnitude of the resultant **R** and the angle θ between the x-axis and the line of action of the resultant for three forces shown above.

Answer to Q2

$\vec{F}_1 + \vec{F}_2 = \vec{F}_{R_1} \dots (1)$

$\vec{F}_{R_1} + \vec{F}_3 = \vec{F}_R \dots (2)$

(1)

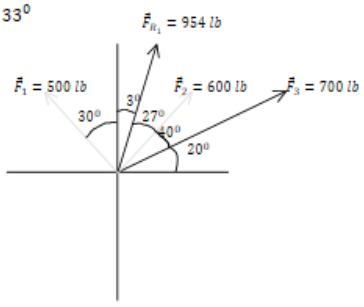


$(F_{R_1})^2 = 500^2 + 600^2 - 2 \times 500 \times 600 \times cos120$

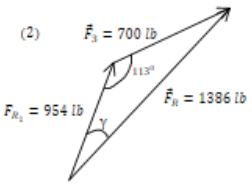
$F_{R_1} = 954\ lb$

From the Law of sines:

$\frac{954\ N}{\sin 120^0} = \frac{600\ N}{\sin \alpha}$ $\alpha = 33^0$



(2)



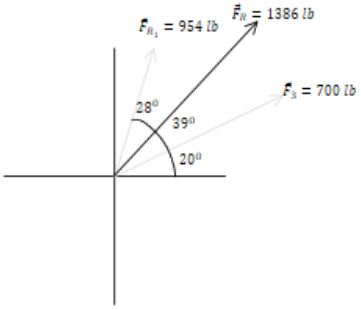
$(F_R)^2 = 954^2 + 700^2 - 2 \times 954 \times 700 \times cos113$

$F_R = 1386\ lb$

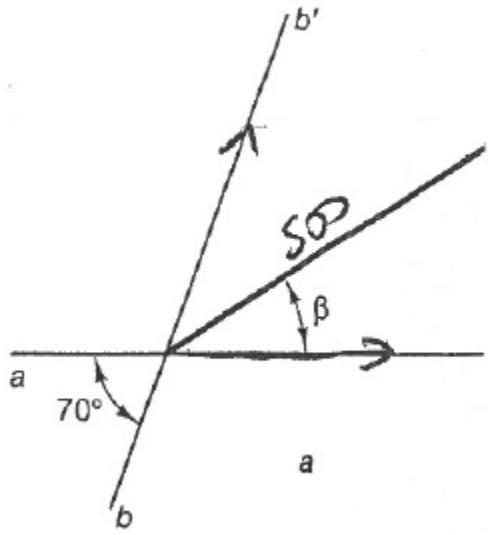
From the Law of sines:

$\frac{1386\ N}{\sin 113^0} = \frac{700}{\sin \gamma}$ $\gamma = 28^0$

$\theta = 67^0 - 28^0 + 20^0 = 59^0$

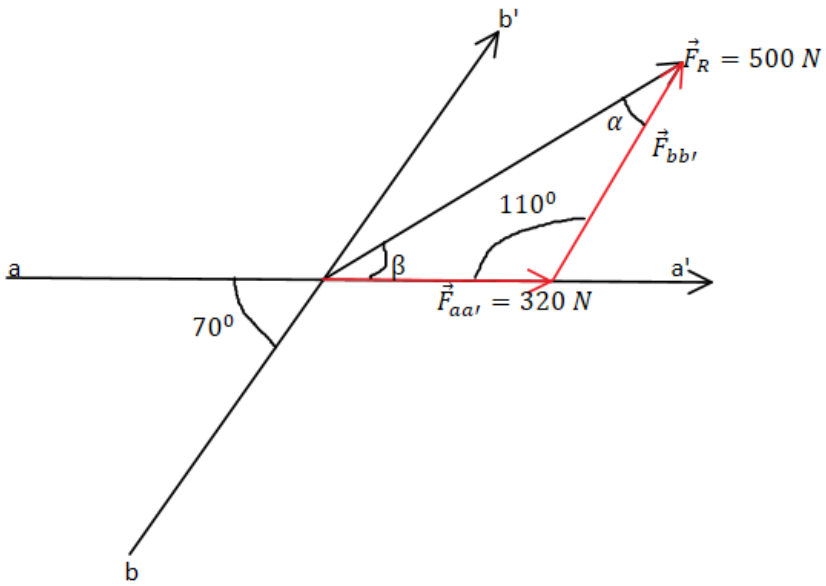


Q3)



A 500-N force is to be resolved into components along lines a-a' and b-b'. Determine the angle β and the component along b-b' if it is known that the component along a-a' is 320 N.

Answer to Q3

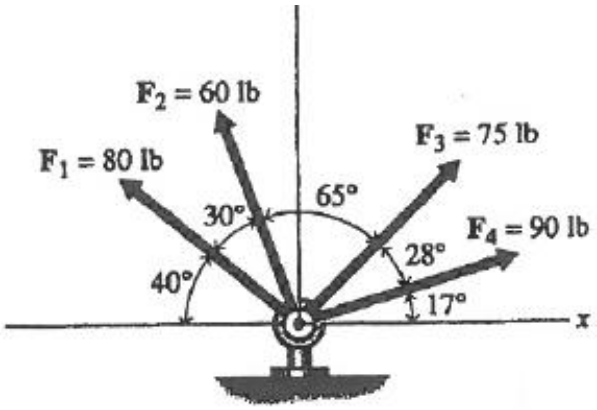


From Law of Sines:

$$\frac{500\ N}{\sin 110^0} = \frac{320\ N}{\sin \alpha} \qquad \alpha = 37^0$$

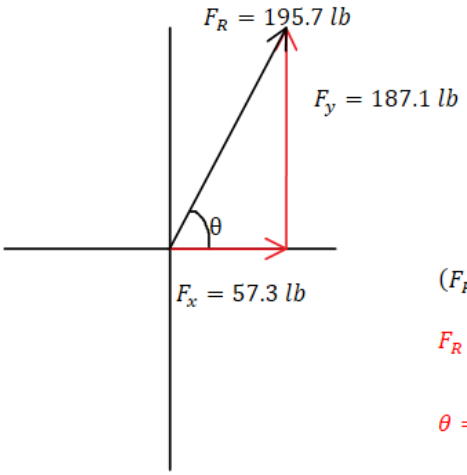
$$\frac{500\ N}{\sin 110^0} = \frac{F_{bb'}}{\sin 33^0} \qquad F_{bb'} = 290\ N$$

Q4)



Determine the magnitude **R** of the resultant of the four forces shown in the figure and the angle θ between the x-axis and the line of action of the resultant.

	F_x (lb)	F_y (lb)
F_1	-61.3	51.4
F_2	-20.5	56.4
F_3	53	53
F_4	86.1	26.3
F_R	**57.3**	**187.1**



$$(F_R)^2 = 57.3^2 + 187.1^2$$

$$F_R = 195.7\ lb$$

$$\theta = tan^{-1}\left(\frac{187.1}{57.3}\right) = 73^0$$