

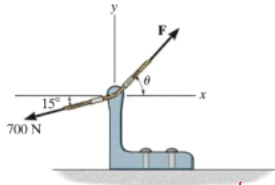
# Homework 1

Sunday, September 6, 2020 6:46 PM

"I pledge my honor I have abided by the Stevens Honor system."

- Alex Jasinski

2-2. If the magnitude of the resultant force is to be 500 N, directed along the positive y axis, determine the magnitude of force **F** and its direction  $\theta$ .



$$\theta = \tan^{-1} \left( \frac{681.17}{676.15} \right)$$

$$\theta = 45.21^\circ$$

$$700 \cos(15) = 676.15 \text{ N}$$

$$700 \sin(15) = 181.17 \text{ N}$$

x-direction

$$F_x - 676.15 = 0$$

$$F_x = 676.15 \text{ N}$$

y-direction

$$F_y - 181.17 = 500$$

$$F_y = 681.17$$

$$F = \sqrt{(681.17)^2 + (676.15)^2}$$

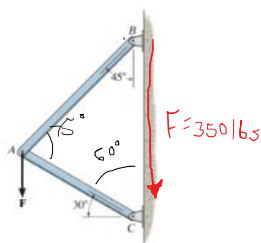
$$F = 959.78 \text{ N}$$

$$F = 959.78 \text{ N @ } 45.21^\circ$$

$$\text{N} \approx \text{E}$$

\*2-4. Determine the magnitudes of the two components of **F** directed along members AB and AC.

2-5. Solve Prob. 2-4 with  $F = 350 \text{ lb}$ .



Law of Sines:

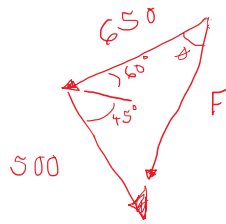
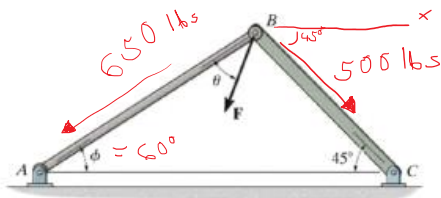
$$\frac{\sin(60)}{F_{AB}} = \frac{\sin(75)}{350}$$

$$F_{AB} = \frac{350 \sin(60)}{\sin(75)} = 313.8 \text{ lbs}$$

$$\frac{\sin(45)}{F_{AC}} = \frac{\sin(75)}{350}$$

$$F_{AC} = \frac{350 \sin(45)}{\sin(75)} = 256.2 \text{ lbs}$$

2-15. Force  $F$  acts on the frame such that its component acting along member  $AB$  is 650 lb, directed from  $B$  towards  $A$ , and the component acting along member  $BC$  is 500 lb, directed from  $B$  towards  $C$ . Determine the magnitude of  $F$  and its direction  $\theta$ . Set  $\phi = 60^\circ$ .



Use law of cosines:

$$F = \sqrt{(650)^2 + (500)^2 - 2(650)(500)\cos(105)}$$

$$F = \sqrt{672500 - 650000\cos(105)}$$

$$F = \sqrt{672500 - (-168232)}$$

$$F = 916.9 \text{ lbs}$$

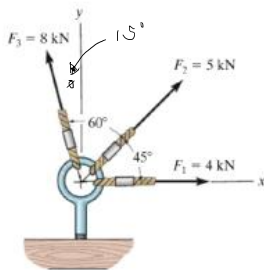
Law of Sines for  $\theta$ :

$$\frac{\sin(\theta)}{500} = \frac{\sin(105)}{916.9}$$

$$\sin(\theta) = .5267261688$$

$$\theta = 31.78^\circ$$

2-33. Determine the magnitude of the resultant force and its direction, measured counterclockwise from the positive  $x$  axis.



x-direction

$$4 + 5\cos(45) - 8\sin(15) = F_{Rx}$$

$$F_{Rx} = 5.46 \text{ kN}$$

y-direction

$$5\sin(45) + 8\cos(15) = F_{Ry}$$

$$F_{Ry} = 11.26 \text{ kN}$$

$$F_R = \sqrt{(5.46)^2 + (11.26)^2}$$

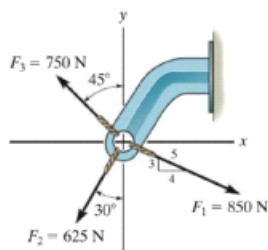
$$F_R = 12.51 \text{ kN @ } 49.55^\circ$$

$$\tan(\theta) = \left( \frac{11.26}{5.46} \right)$$

$$\theta = \tan^{-1}\left( \frac{11.26}{5.46} \right)$$

$$\theta = 64.13^\circ$$

2-35. Determine the magnitude of the resultant force and its direction, measured counterclockwise from the positive x axis.



x-direction

$$680 - 750 \sin(45) - 625 \sin(30) = F_{Ax}$$

$$F_{Ax} = -162.83 \text{ N}$$

y-direction

$$750 \cos(45) - 625 \cos(30) - 510 = F_{Ay}$$

$$F_{Ay} = -520.93 \text{ N}$$

$$\tan(\theta) = \left( \frac{-520.93}{-162.83} \right)$$

$$\theta = 72.64^\circ + 180^\circ$$

$$\theta = 252.64^\circ$$

$$F_R = \sqrt{(-162.83)^2 + (-520.93)^2}$$

$$F_R = 545.79 \text{ N} @ 252.64^\circ$$