Architecture Engineering Department

Engineering mechanics

Lecture 7:

Examples about Equilibrium

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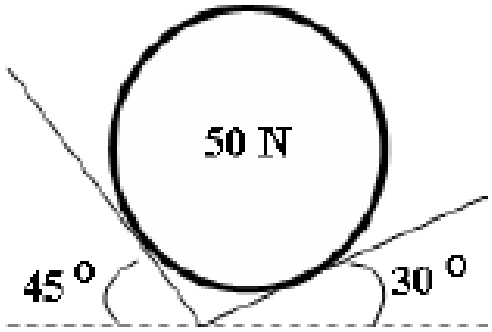
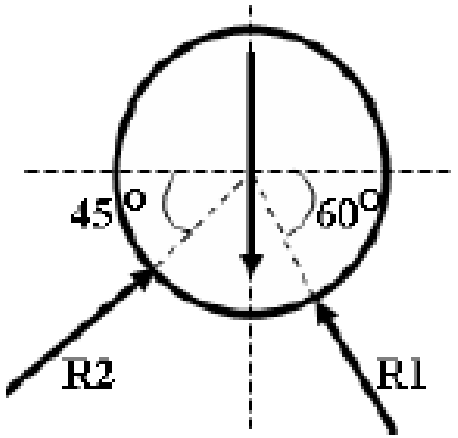
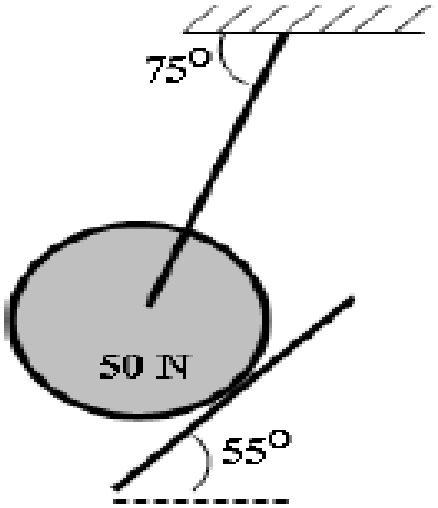
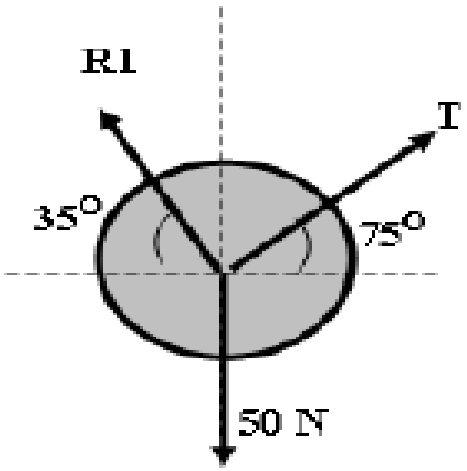
Ex1:Draw Free – body diagram for the 50 N sphere shown in fig.





Ex2:Draw Free – body diagram for the 50 N sphere shown in fig.





$$\overset{+}{\rightarrow}\sum F_x = 0$$

$$T\cos(75) - R_1\cos(35) = 0$$

$$T\cos(75) = R_1\cos(35)$$

$$T = \frac{\cos(35)}{\cos(75)}R_1 = 3.165R_1 \qquad .....(1)$$

$$+\uparrow \sum F_y = 0$$

$$T\sin(75) + R_1\sin(35) - 50 = 0$$

$$T\sin(75) + R_1\sin(35) = 50 \qquad .....(2)$$

$$Sub.Eq.(1)\,\text{int}\,o\;\;Eq.(2)$$

$$(3.165R_1)\sin(75)+R_1\sin(35)=50$$

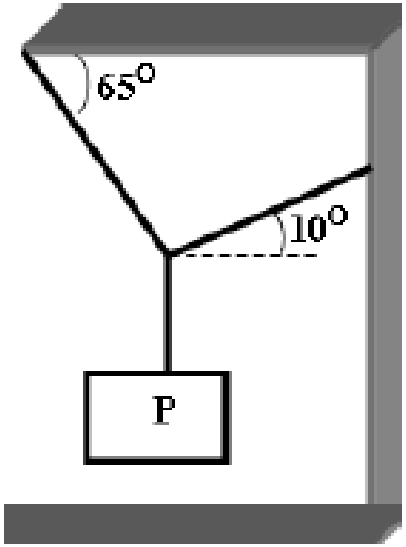
$$3.63R_1=50$$

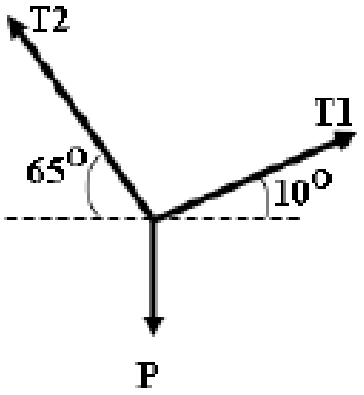
$$R_1=13.774N$$

$$Sub.R_1\,\text{int}\,o\;\;Eq.(1)$$

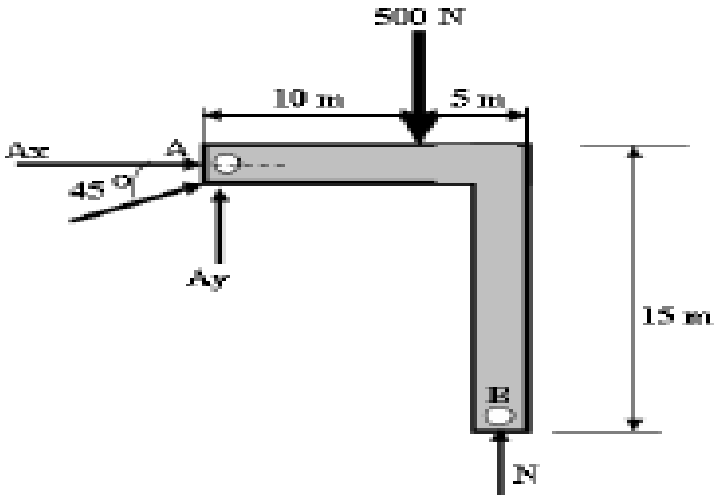
$$T=3.165(13.774)=43.6N$$

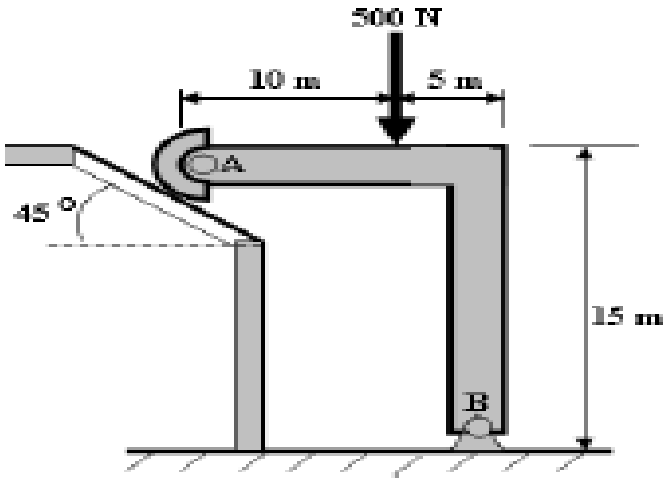
Ex3:Draw Free – body diagram for the ropes system shown in fig.





Ex2: Determine the reactions at the points (A) and (B) , the angle beam was in equilibrium state as shown in figure.





Solution:

$$\Sigma M(A) = 0$$

$$500 * 10 - N * 15 = 0$$

$$N = 5000 / 15 = 333.34 \text{ N}$$

$$\Sigma Fy = 0$$

$$Ay + N - 500 = 0$$

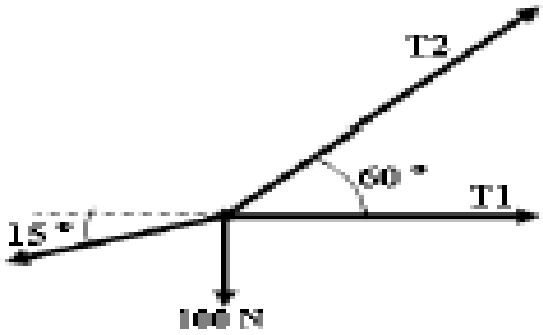
$$Ay + 333.34 - 500 = 0$$

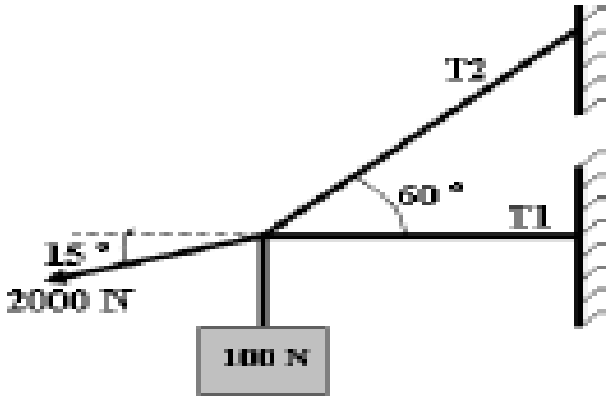
$$Ay = 166.67 \text{ N}$$

$$\Sigma Fx = 0 \quad , Ax = 0$$

$$RA = Ay = 166.67 \text{ N}$$

Ex3: Determine the tension forces (T1) and (T2) in the equilibrium system shown in figure.





Solution:

$$\Sigma Fx = 0$$

$$T1 \cdot \cos(0) + T2 \cdot \cos(60) - 2000 \cos(15) = 0$$

$$T1 + 0.5\,T2 - 1931.85 = 0 \quad \ldots\ldots\ldots \quad (1)$$

$$\Sigma Fy = 0$$

$$T1 \cdot \sin(0) + T2 \cdot \sin(60) - 2000 \cdot \sin(15) - 100 = 0$$

$$0.866\,T2 - 617.63 = 0$$

$$T2 = 713.2\ N$$

Subs. in (1)

$$T1 = 1575\ N$$

Ex: Determine the tension in each cord shown in fig. (TA , TB , TC , TD).