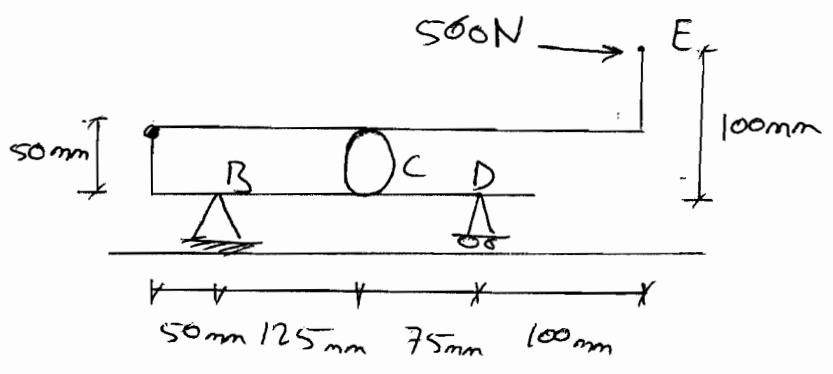


CE-201 Section 485  
(071) H.W 9

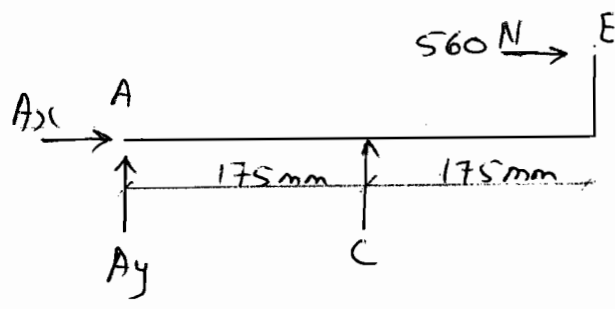
Problem 1

Given: Fig P.

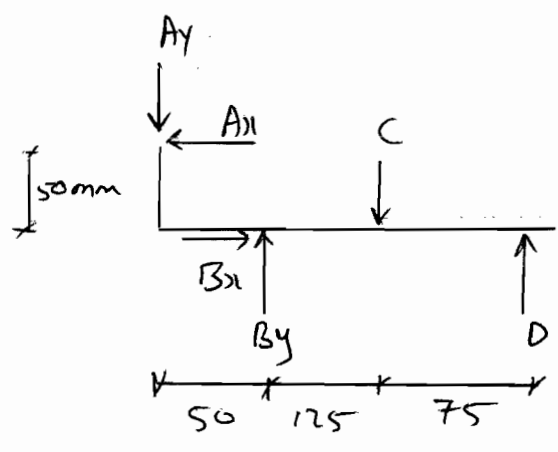
Required:  
Components of all  
members



Solution:-



FBD 1



FBD 2

By taking Moment around A (FBD 1)

$$\sum \tau_A = 0$$

$$(-560)(50) + (C)(175) = 0$$

$$C = 160 \text{ N.}$$

$C = 160 \text{ N.}$

$$\rightarrow \sum F_x = 0$$

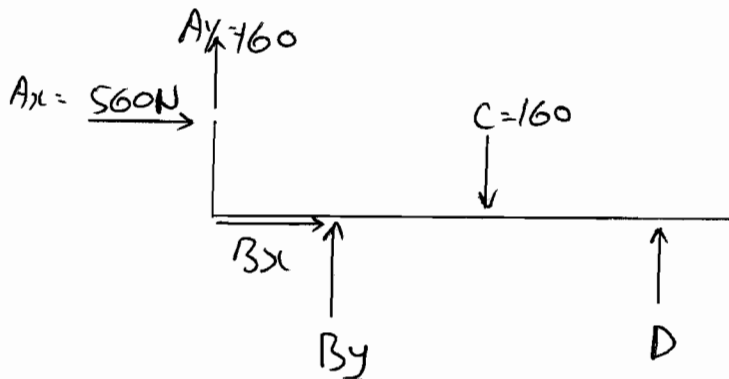
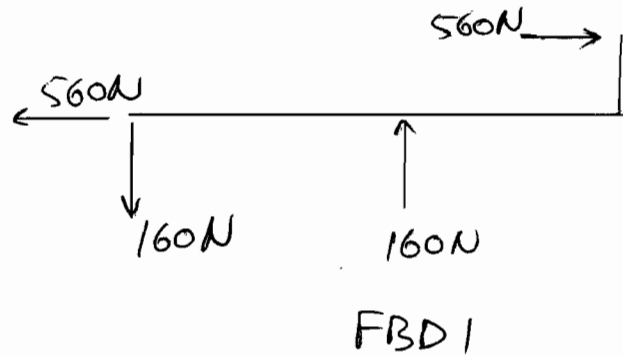
$$A_x = -560 \text{ N}$$

$$A_x = 560 \text{ N} \leftarrow$$

$$\uparrow \sum F_y = 0$$

$$A_y = 160 \text{ N}$$

$$\therefore A_y = 160 \text{ N} \downarrow$$



By taking Moment around B (FBD 2)

$$+\circlearrowleft \sum M_B = 0$$

$$(-560)(50) - (160)(50) - (160)(125) + D(200) = 0$$

$$D = 280 \text{ N} \uparrow$$

$$\uparrow \sum F_y = 0$$

$$280 - 160 + 160 + B_y = 0$$

$$B_y = 280 \text{ N} \downarrow$$

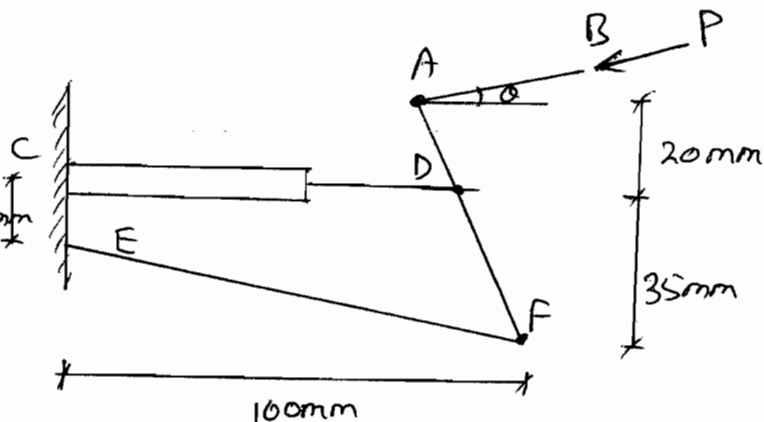
$$\rightarrow \sum F_x = 0$$

$$B_x = 560 \text{ N} \leftarrow$$

Problem 2:

Given: Fig P1

Tension at link EF = 450N  
 $\alpha = 10^\circ$



Required:

- calculate P.
- Force exerted on member ADF at D.

Solution:

$\sum M_D = 0$  FBD (Why did we choose that part?!)

$$(450) \left( \frac{20}{\sqrt{10400}} \right) (35 \tan 20) - (450) \left( \frac{100}{\sqrt{10400}} \right) (35) + P(\cos 10)(20) + (20 \tan 20)(P \sin 10) = 0$$

$$P = 683.1947 \text{ N.}$$

$$\sum F_x = 0$$

$$(-450) \left( \frac{100}{\sqrt{10400}} \right) - P \cos 10 + D_x = 0$$

$$D_x = 1114.077 \text{ N}$$

$$\sum F_y = 0$$

$$450 \left( \frac{20}{\sqrt{10400}} \right) - P \sin 10 + D_y = 0$$

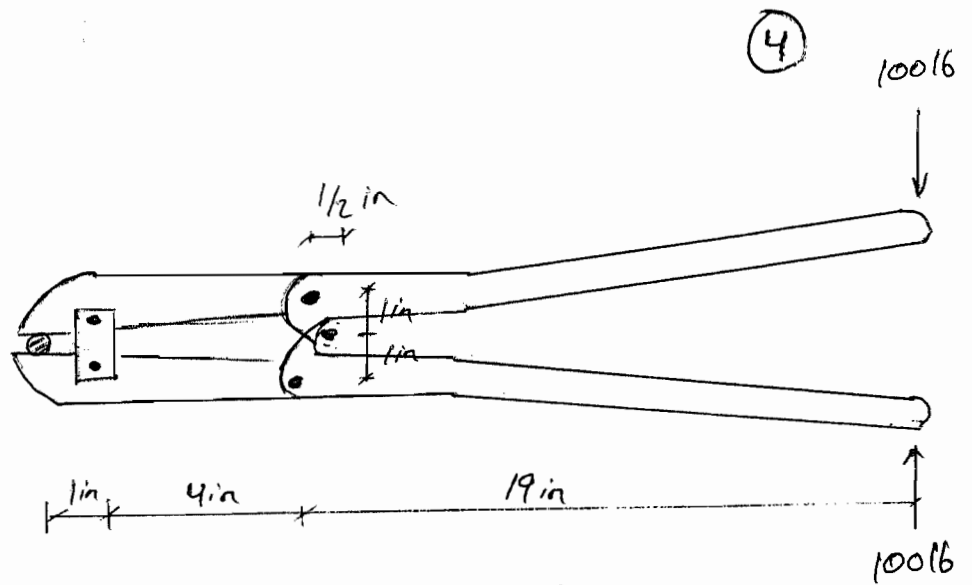
$$D_y = 30.383 \downarrow \quad \theta = \tan^{-1} \left( \frac{D_x}{D_y} \right) = 1.56^\circ$$

### Problem 3

Given:

Fig P3

Required:  
Magnitude of force exerted on the bolt.



Solution.

From FBD ①

$$\sum F_x = 0$$

$$B_x = 0$$

From FBD ②

$$\sum M_c = 0$$

$$\left(\frac{1}{2}\right)(B_y) - (100)(18.5) = 0$$

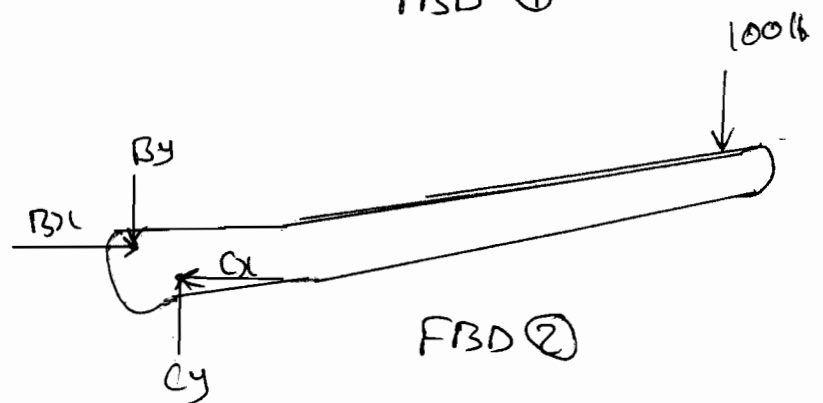
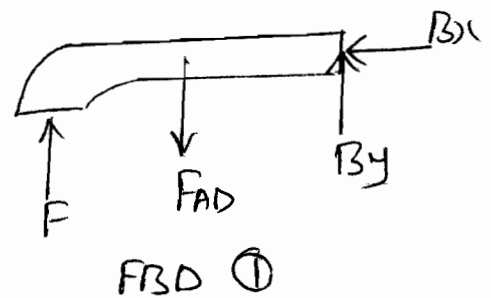
$$B_y = 3700 \text{ lb } \downarrow$$

Again From FBD ①

$$\sum M_A = 0$$

$$(-F)(1) + (B_y)(4) = 0, \text{ where } B_y = 3700 \text{ lb}$$

$$F = 14800 \text{ lb}$$



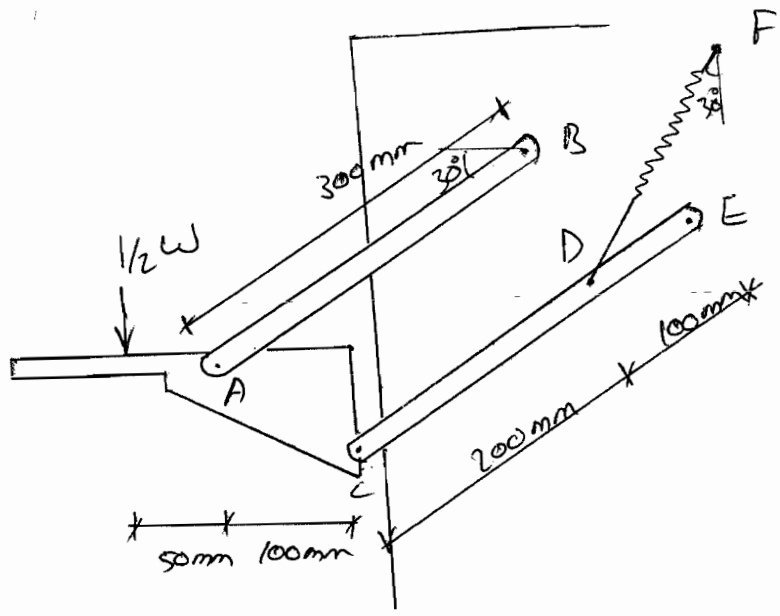
Problem 4:

Given:-  
Fig P4

$w = 20 \text{ kg} \times 9.81$

Required:-

- a) Force at link AB
- b) tension in the Spring

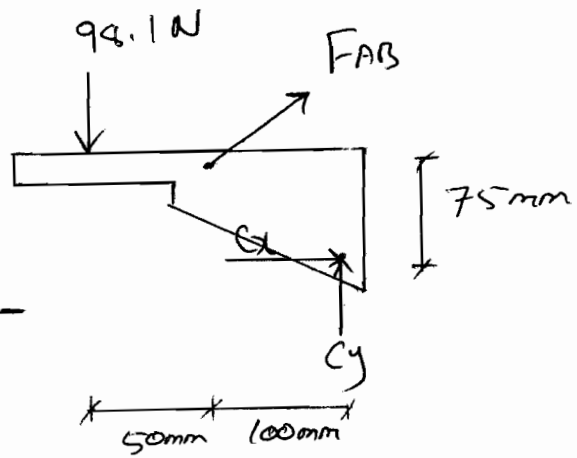


Solution:-

From FBD ①

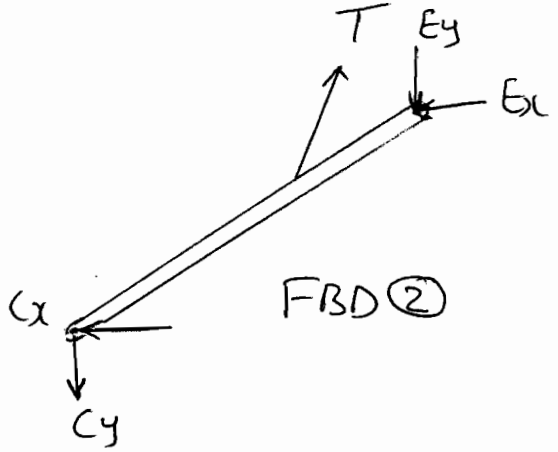
$\sum \tau_C = 0$   
 $(98.1)(150) - (F_{AB})(\cos 30)(75) - (F_{AB})(\sin 30)(100) = 0$

$F_{AB} = 128.01 \text{ N}$



FBD ①

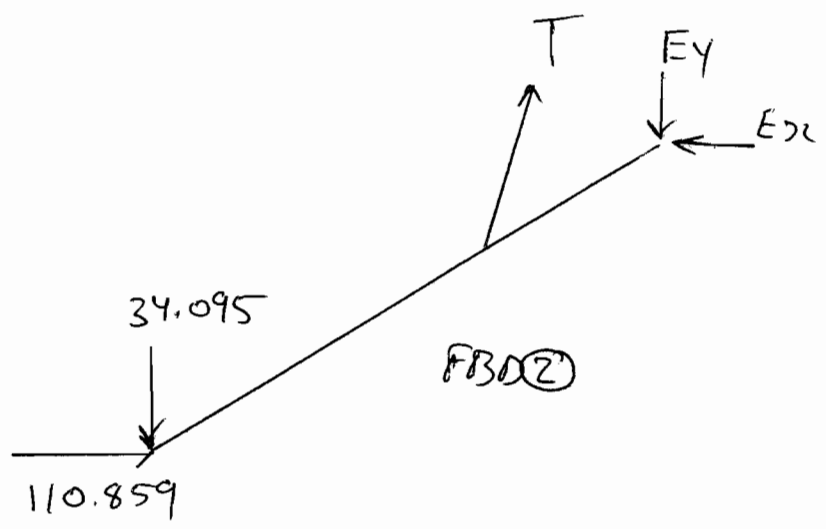
$\sum F_x = 0$   
 $C_x + (F_{AB})(\cos 30) = 0$   
 $C_x = -110.859 \text{ N}$   
 $C_x = 110.859 \text{ N} \leftarrow$



FBD ②

From FBD ①  
 $\sum F_y = 0$   
 $-98.1 + (F_{AB})(\sin 30) + C_y = 0$   
 $C_y = 34.095 \text{ N} \uparrow$

6



From FBD (2)

$$\sum M_E = 0$$

$$(110.859)(\sin 30) + (34.095)(\cos 30) - (T)(\sin 60)(\cos 30)(100) + T(\cos 60)(\sin 30)(100) = 0$$

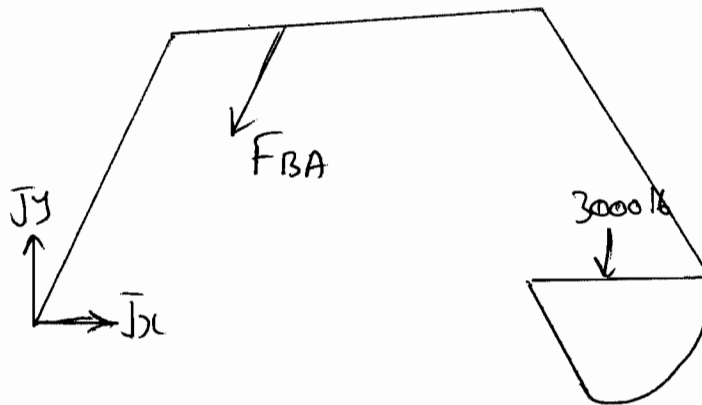
$$\therefore -50T = -25486.991$$

$$T = 509.739 \text{ N}$$



8/9

$$\therefore F_{CD} = 4268.25416 \text{ T}''$$



$$+\circlearrowleft \sum \mathcal{M}_J = 0$$

$$- (3000)(22) - (F_{BA}) \left( \frac{9}{\sqrt{9^2+3^2}} \right) (6) + (F_{BA}) \left( \frac{3}{\sqrt{9^2+3^2}} \right) (7) = 0$$

$$- F_{BA} \left( \frac{33}{\sqrt{9^2+3^2}} \right) = 66000$$

$$F_{BA} = -18973.665 \text{ lb}$$

$$F_{BA} = -18973.7 \text{ lb} \text{ "C"}$$