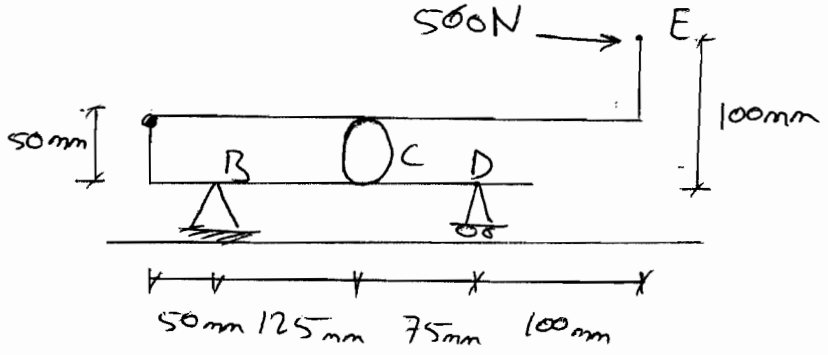
CE-201 Section 4/5
(071) H.W 9

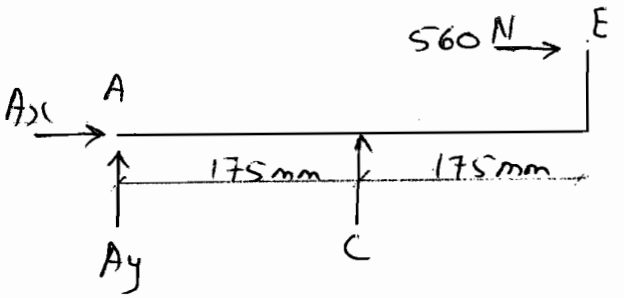
Problem 1

Given: Fig P1

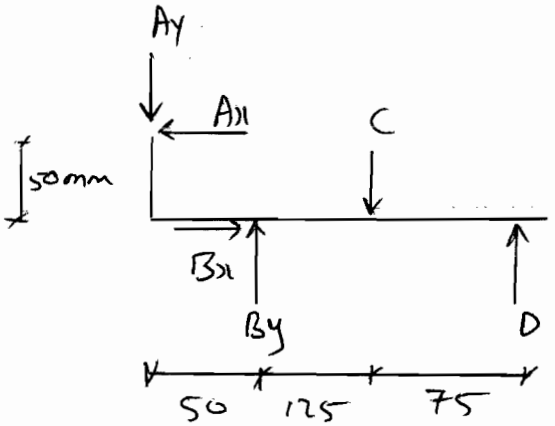
Required:
Components of all members



Solution:



FBD 1



FBD 2

By taking Moment around A (FBD 1)

$+\circlearrowleft \sum M_A = 0$

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

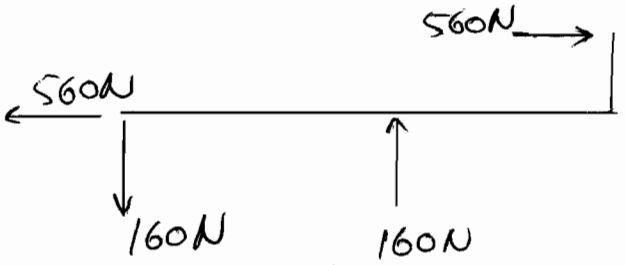
$C = 160\ N.$

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

$\xrightarrow{+} \Sigma F_x = 0$

$A_x = -560\ N$

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

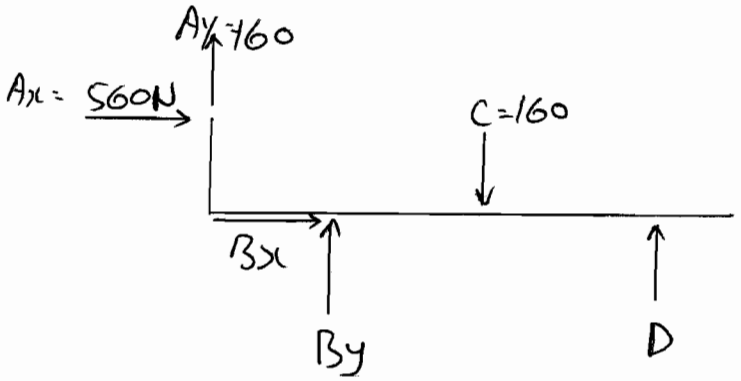


FBD 1

$\overset{+}{\uparrow} \Sigma F_y = 0$

$A_y = 160\ N$

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



FBD 2

By taking Moment around B (FBD 2)

$+\circlearrowleft \Sigma M_B = 0$

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

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

$\overset{+}{\uparrow} \Sigma F_y = 0$

$280 - 160 + 160 + B_y = 0$

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

$\xrightarrow{+} \Sigma F_x = 0$

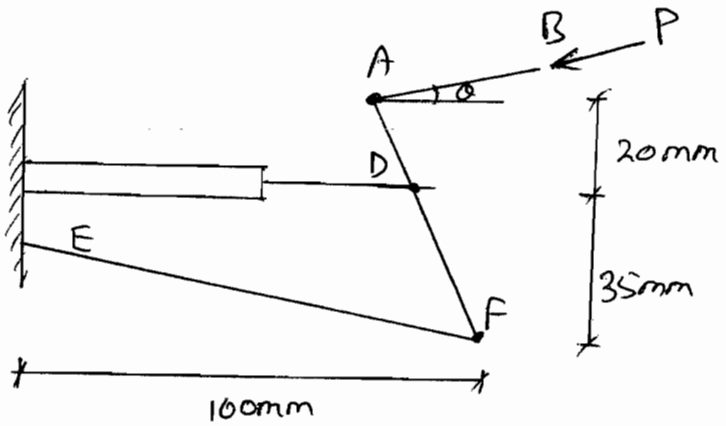
$\boxed{B_x = 560\ N \leftarrow}$

Problem 2:.

Given: Fig P1

Tension at link EF = 450N

$\theta = 10°$



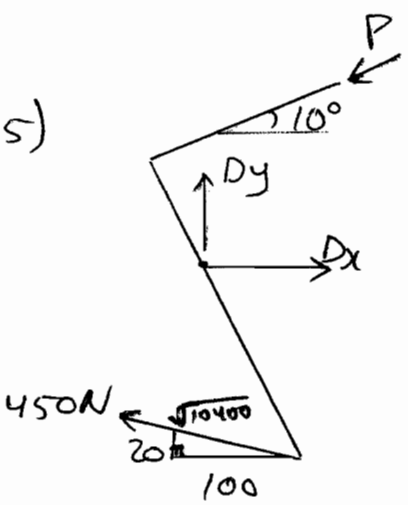
Required:

a) Calculate P.

b) Force exerted on member ADF at D.

Solution:

FBD (Why did we choose that part ?!)



FBD

$+\circlearrowleft \Sigma M_D = 0$

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

$$P = 683.1947\ N.$$

$\rightarrow \Sigma F_x = 0$

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

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

$\uparrow^{+} \Sigma F_y = 0$

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

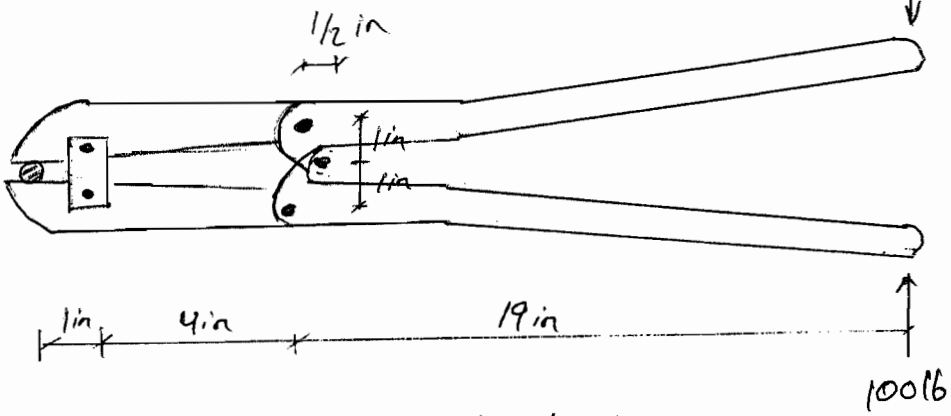
$$\boxed{D_y = 30.383\ \downarrow} \qquad \theta = \tan^{-1}\left(\frac{D_x}{D_y}\right)$$

$$\boxed{\theta = 1.56°}$$

Problem 3

Given:

Fig P3



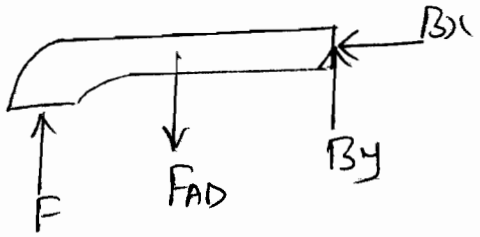
Required:
Magnitude of force exerted on the bolt.

Solution.

From FBD ①

$\rightarrow \sum F_x = 0$

$\boxed{B_x = 0}$



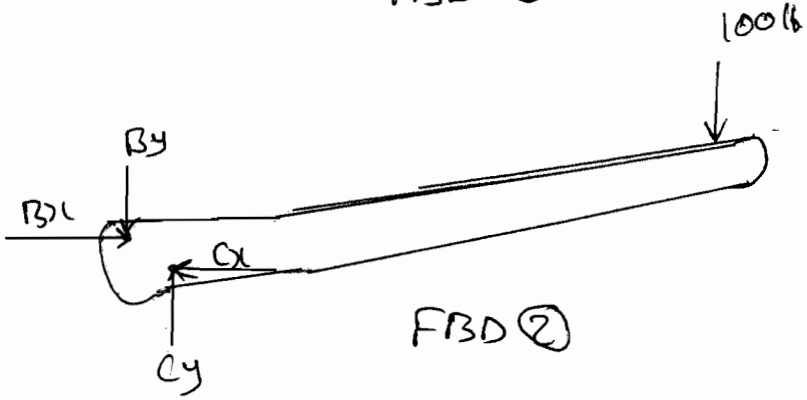
FBD ①

From FBD ②

$+\circlearrowleft \sum M_C = 0$

$(1/2)(B_y) - (100)(18.5) = 0$

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



FBD ②

Again From FBD ①

$+\circlearrowleft \sum M_A = 0$

$(-F)(1) + (B_y)(4) = 0$, where $B_y = 3700$ lb

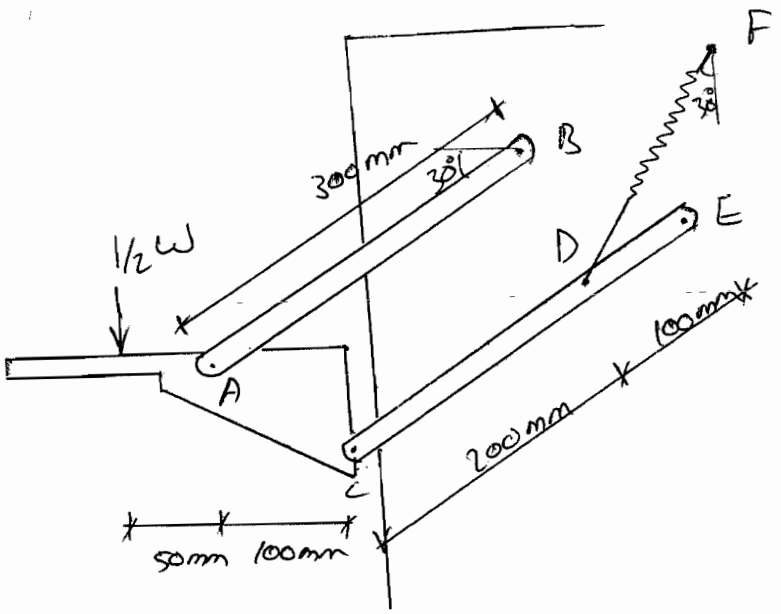
$\boxed{F = 14800 \text{ lb}}$

Problem 4:-

Given:-

Fig P4

$W = 20\,kg \times 9.81$



Required:-

a) Force at link AB
b) tension in the spring

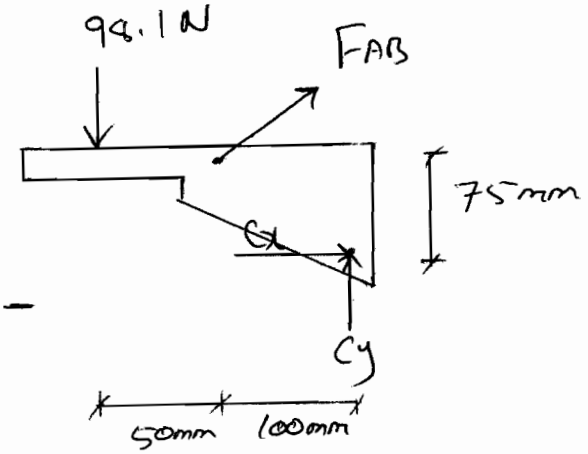
Solution:-

From FBD ①

$+\circlearrowleft \Sigma M_C = 0$

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

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



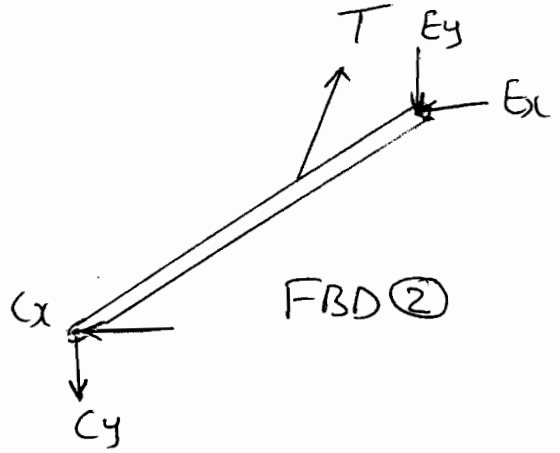
FBD ①

$\rightarrow \pm \Sigma F_x = 0$

$C_x + (F_{AB})(\cos 30) = 0$

$C_x = -110.859\,N$

$C_x = 110.859\,N \leftarrow$



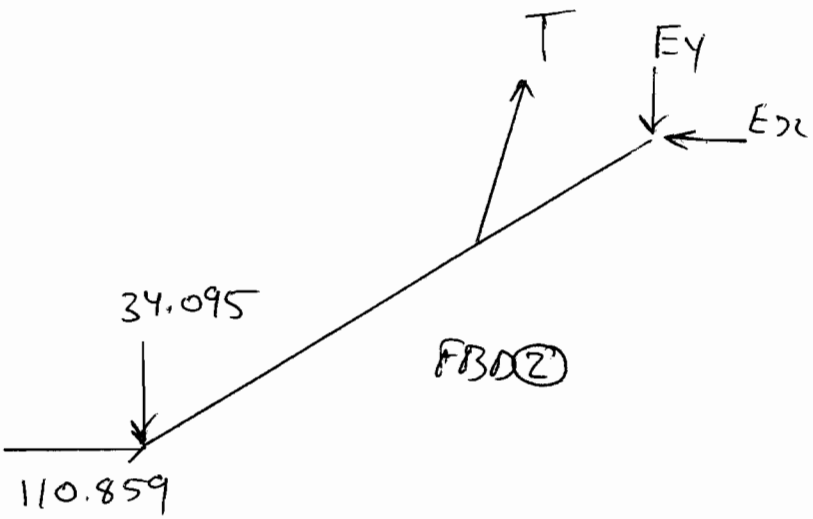
FBD ②

From FBD ①

$+\uparrow \Sigma F_y = 0$

$-98.1 + (F_{AB})(\sin 30) + C_y = 0$

$C_y = 34.095\ N \uparrow$



From FBD②

$\curvearrowright \Sigma M_E = 0$

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

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

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

Problem 5:

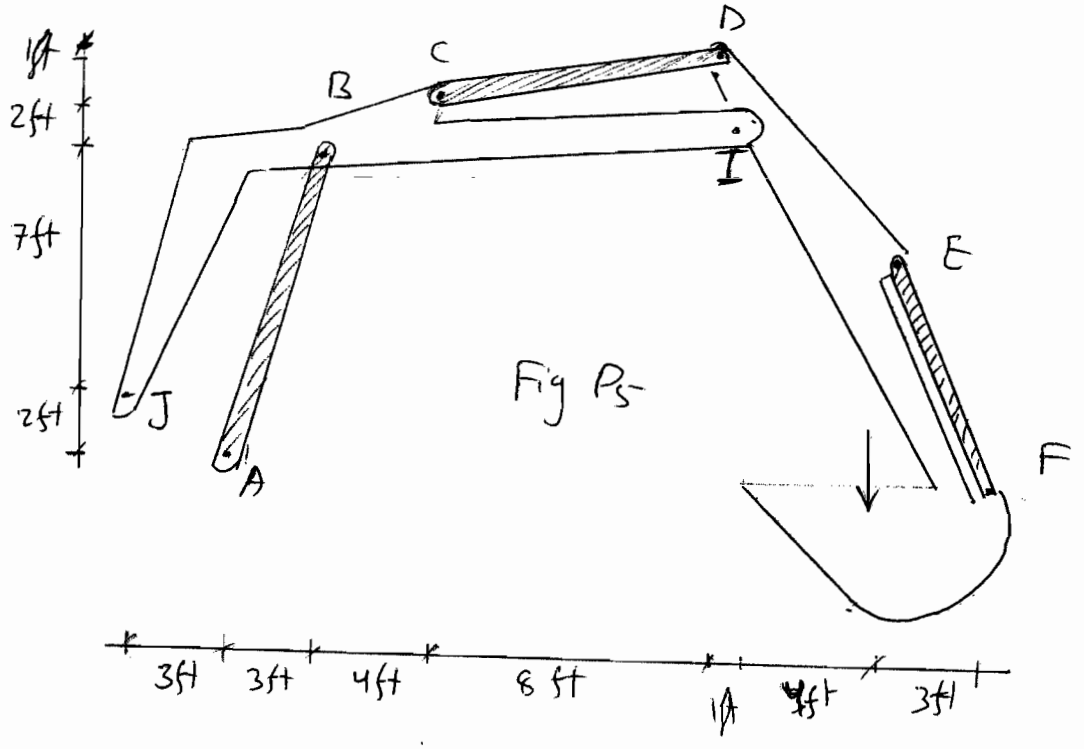


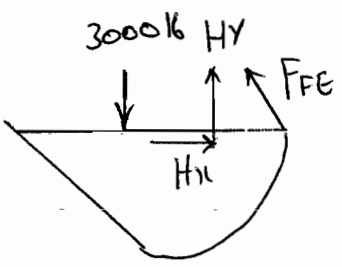
Fig P5-

Given: Fig P5-

Required: Force exerted by each cylinder.

Solution:

From FBD ①



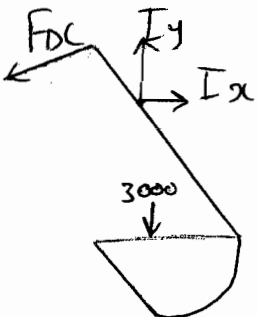
FBD ①

$$+\circlearrowleft \sum M_H = 0$$

$$(3000)(3) + (F_{FE})\left(\frac{8}{\sqrt{3^2+8^2}}\right)(1) = 0$$

$$F_{FE} = -9612.00416$$

$$\boxed{F_{FE} = 9612.00416 \text{ "C"}}$$



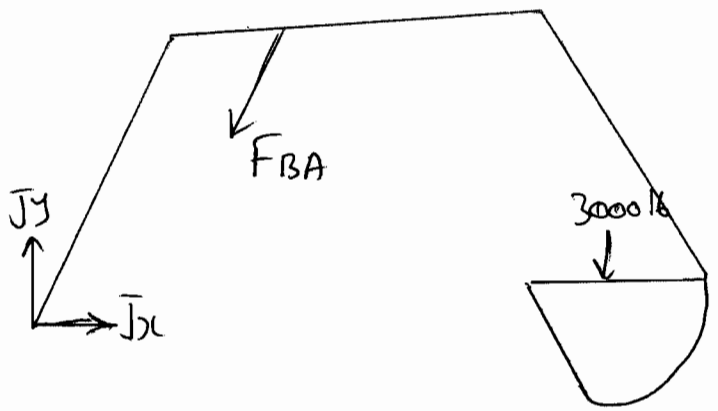
FBD ②

From FBD ②

$$+\circlearrowleft \sum M_I = 0$$

$$-(3000)(3) + (F_{CD})\left(\frac{8}{\sqrt{1^2+8^2}}\right)(2) + F_{CD}\left(\frac{1}{\sqrt{1+8^2}}\right)(1) = 0$$

$\therefore$ $F_{CD} = 4268.2541\text{6 lb}$ "T"



$+\circlearrowleft \Sigma M_J = 0$

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

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

$F_{BA} = -18973.665$ lb

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