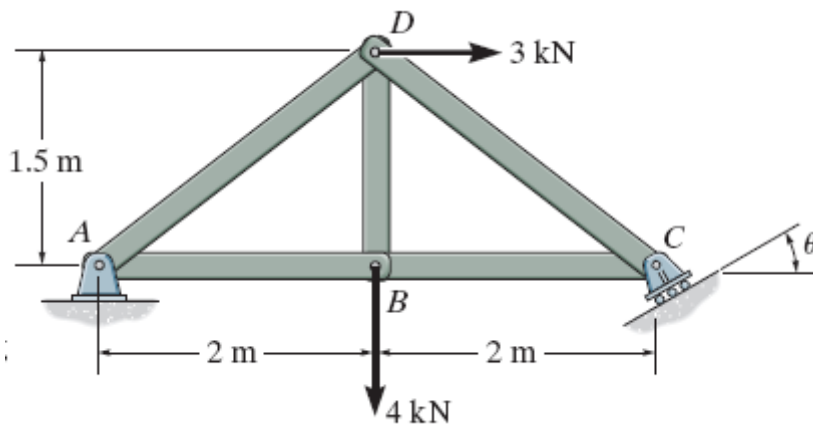


## CHAPTER VI- SIMPLE TRUSSES, FRAMES AND MACHINES

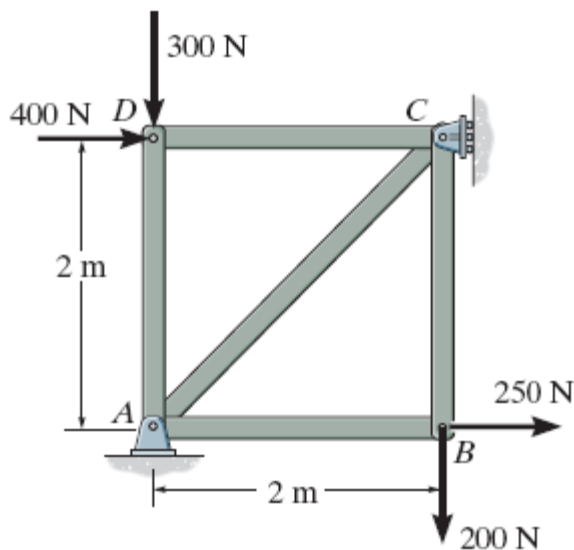
1- Determine the force in each member of the truss, and state if the members are in tension or compression. Set  $\theta = 30^\circ$ .

( $F_{AB} = 2.362 \text{ kN} = 2.36 \text{ kN (T)}$ ,  $F_{AD} = 1.458 \text{ kN} = 1.46 \text{ kN (C)}$ ,  $F_{CB} = 2.362 \text{ kN} = 2.36 \text{ kN (T)}$ ,  $F_{CD} = 5.208 \text{ kN} = 5.21 \text{ kN (C)}$ )



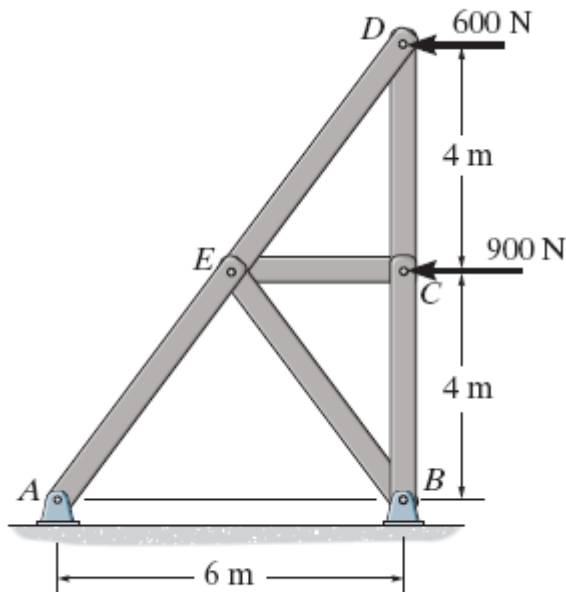
2- Determine the force in each member of the truss, and state if the members are in tension or compression.

( $N_C = 600 \text{ N}$ ,  $F_{CA} = 283 \text{ N (C)}$ ,  $F_{BC} = 200 \text{ N (T)}$ ,  $F_{BA} = 250 \text{ N (T)}$ ,  $F_{DA} = 300 \text{ N (C)}$ ,  $F_{DC} = 400 \text{ N (C)}$ )



3- Determine the force in each member of the truss, and state if the members are in tension or compression.

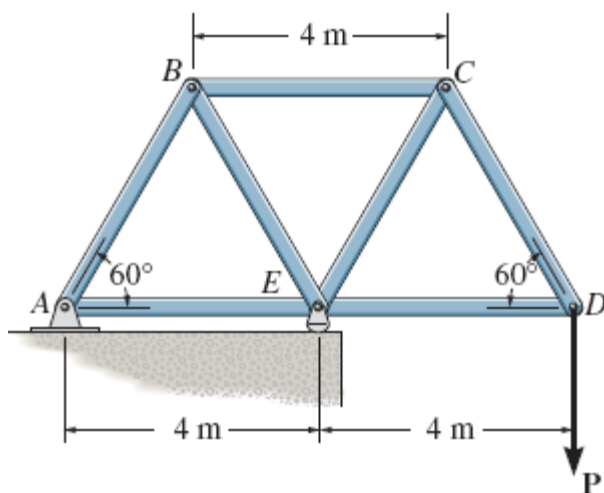
( $F_{EA} = 1750 \text{ N} = 1.75 \text{ kN (C)}$ ,  $F_{EB} = 750 \text{ N (T)}$ ,  $F_{CB} = 800 \text{ N (T)}$ ,  $F_{CB} = 0$ ,  $F_{CE} = 900 \text{ N (C)}$ ,  $F_{DC} = 800 \text{ N (T)}$ ,  $F_{DC} = 0$ ,  $F_{DE} = 1000 \text{ N} = 1.00 \text{ kN (C)}$ )



4- Determine the force in each member of the truss. State whether the members are in tension or compression. Set  $P = 8 \text{ kN}$ .

( $F_{EA} = 4.62 \text{ kN}$ ,  $F_{BE} = 9.24 \text{ kN (C)}$ ,  $F_{BA} = 9.24 \text{ kN}$ ,  $F_{CB} = 9.238 \text{ kN (T)}$ ,  $F_{CB} = 0$ ,  $F_{CE} = 9.238 \text{ kN}$ ,  $F_{DE} = 4.619 \text{ kN (c)}$ ,  $F_{DC} = 9.238 \text{ kN (T)}$ )

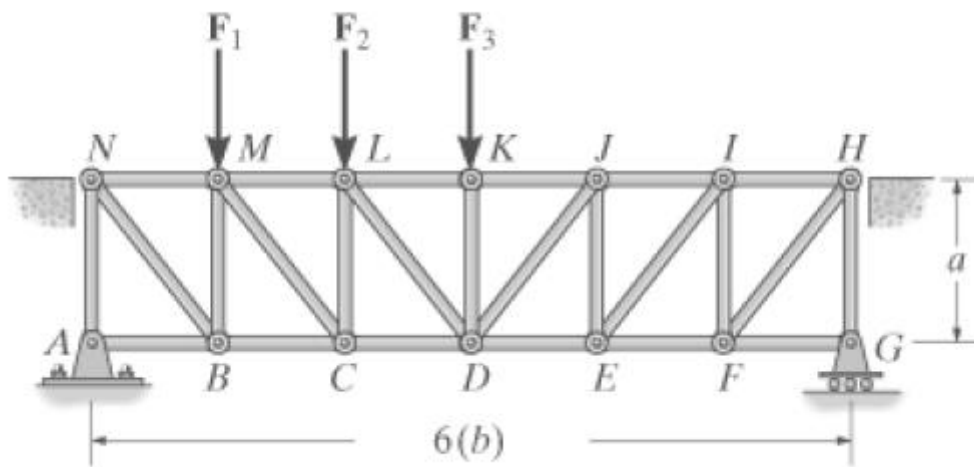
+



5- The Pratt bridge truss is subjected to the loading shown. Determine the force in members LD, LK, CD, and KD, and state if the members are in tension or compression. Given:  $F_1 = 50 \text{ kN}$ ,  $F_2 = 50 \text{ kN}$ ,  $F_3 = 50 \text{ kN}$ ,  $a = 4 \text{ m}$ ,  $b = 3 \text{ m}$ .

$$\begin{pmatrix} F_{LD} \\ F_{LK} \\ F_{CD} \\ F_{KD} \end{pmatrix} = \begin{pmatrix} 0 \\ -112.5 \\ 112.5 \\ -50 \end{pmatrix} \text{ kN}$$

Positive (T)  
Negative (C)

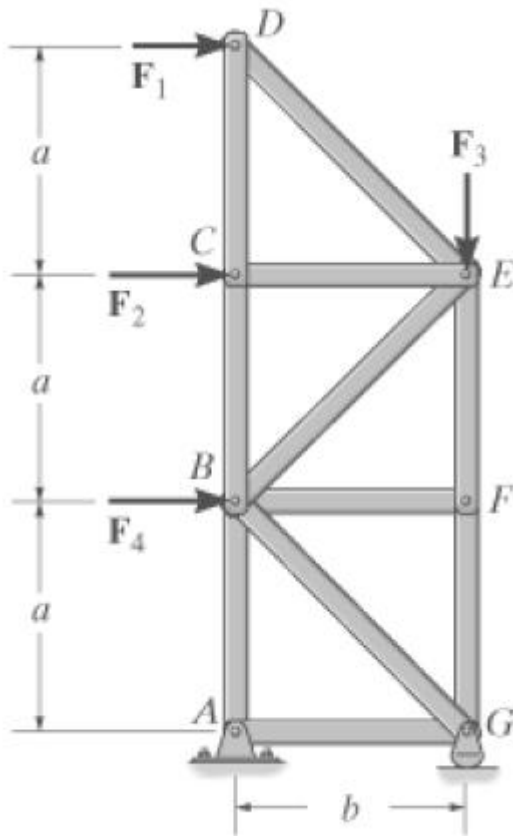


6- Determine the force in members BF, BG, and AB, and state if the members are in tension or compression. Given:  $F_1 = 5 \text{ kN}$ ,  $F_4 = 10 \text{ kN}$ ,  $F_2 = 10 \text{ kN}$ ,  $a = 4 \text{ m}$ ,  $F_3 = 5 \text{ kN}$ ,  $b = 4 \text{ m}$ .

$$\begin{pmatrix} F_{AB} \\ F_{BG} \\ F_{BF} \end{pmatrix} = \begin{pmatrix} 45 \\ -35.4 \\ 0 \end{pmatrix} \text{ kN}$$

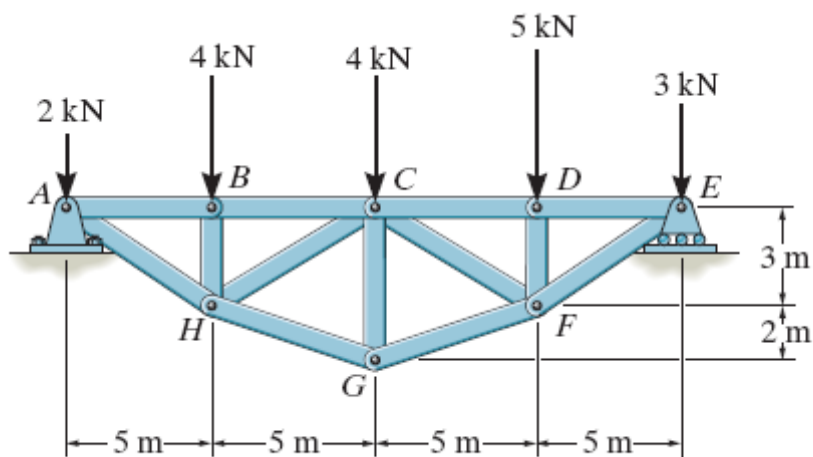
Positive (T)  
Negative (C)

Ans.



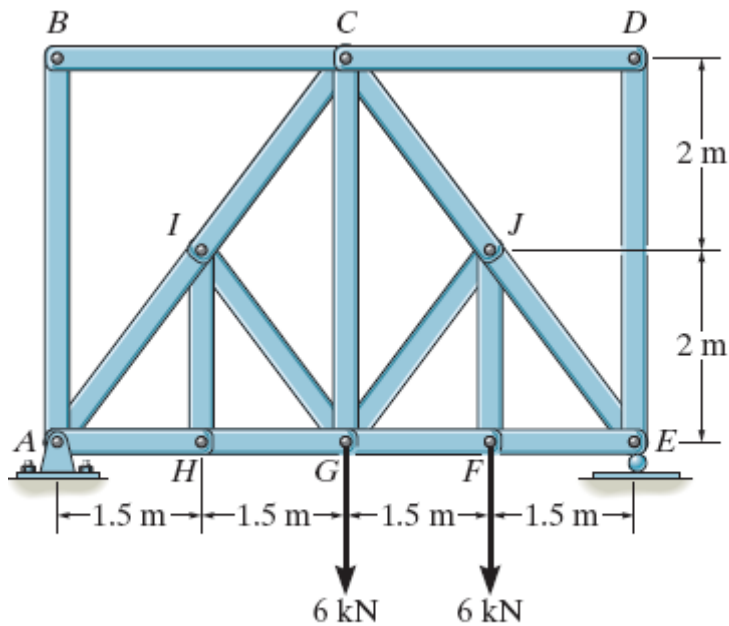
7- Determine the force in members  $BC$ ,  $HC$ , and  $HG$ . After the truss is sectioned use a single equation of equilibrium for the calculation of each force. State if these members are in tension or compression.

(.FHG = 9.1548 = 9.15 kN (T), FBC = 10.4 kN (C), FHC = 2.24 kN (T))



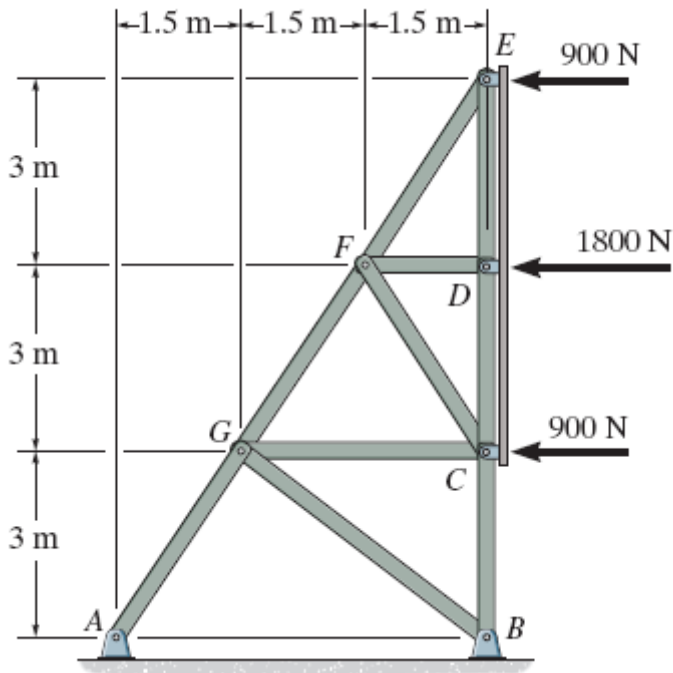
8- Determine the force in members  $JE$  and  $GF$  of the truss and state if these members are in tension or compression. Also, indicate all zero-force members.

( $AB, BC, CD, DE, HI,$  and  $GI$  are zero-force members,  $F_{JE} = 9.375 = 9.38 \text{ kN (C)}$ ,  $F_{GF} = 5.62 \text{ kN (T)}$ ).



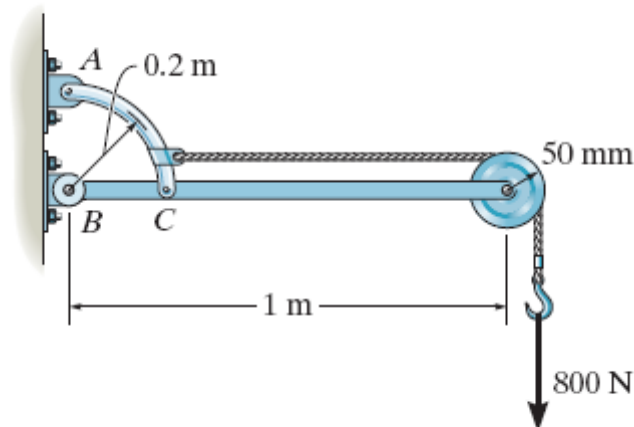
9- Determine the force in members  $FG, GC$  and  $CB$  of the truss used to support the sign, and state if the members are in tension or compression.

( $F_{CB} = 3600 \text{ N} = 3.60 \text{ kN (T)}$ ,  $F_{GC} = 1800 \text{ N} = 1.80 \text{ kN (C)}$ ,  $F_{FG} = 4024.92 \text{ N} = 4.02 \text{ kN (C)}$ )



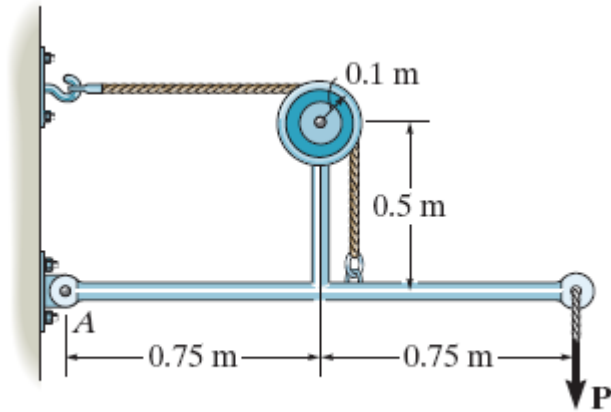
10- Determine the horizontal and vertical components of force that the pins at  $A, B,$  and  $C$  exert on their connecting members.

( $A_x = 4200 \text{ N} = 4.20 \text{ kN}$ ,  $B_x = 4200 \text{ N} = 4.20 \text{ kN}$ ,  $A_y = 4000 \text{ N} = 4.00 \text{ kN}$ ,  $B_y = 3.20 \text{ kN}$ ,  $C_x = 3.40 \text{ kN}$ ,  $C_y = 4.00 \text{ kN}$ )



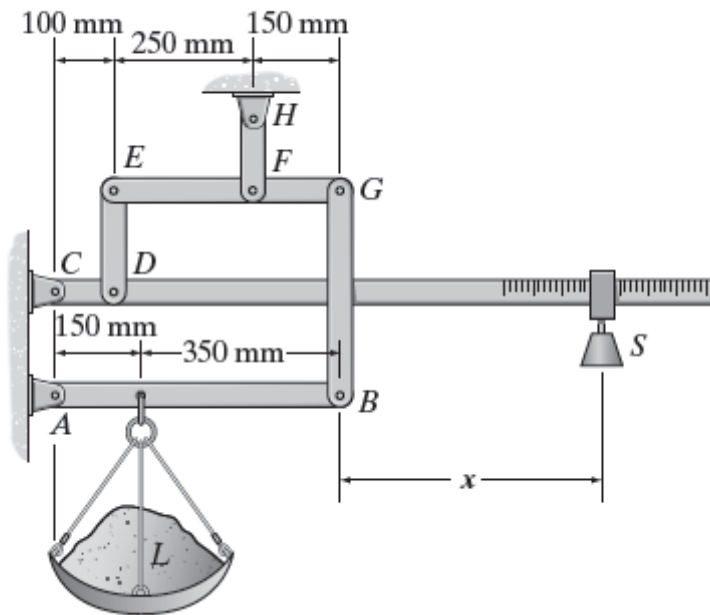
11- Determine the greatest force  $P$  that can be applied to the frame if the largest force resultant acting at  $A$  can have a magnitude of 2 kN.

( $P = 0.743 \text{ kN} = 743 \text{ N}$ )



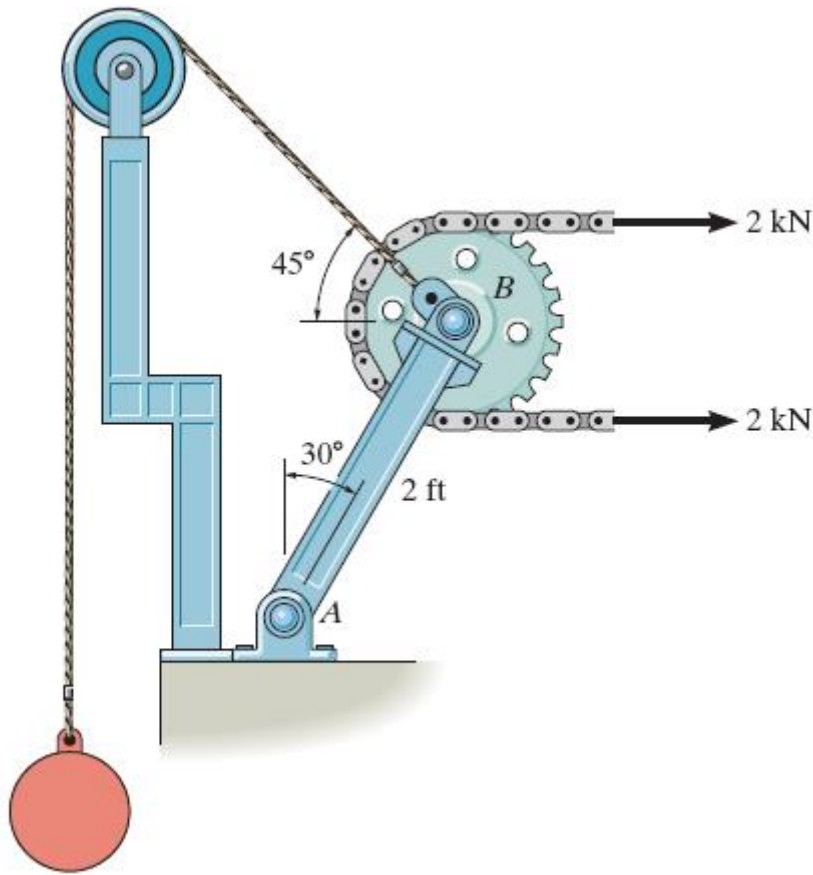
12- The platform scale consists of a combination of third and first class levers so that the load on one lever becomes the effort that moves the next lever. Through this arrangement, a small weight can balance a massive object. If  $x=450$  mm and, the mass of the counterweight  $S$  is 2 kg, determine the mass of the load  $L$  required to maintain the balance.

( $m=106$  kg)



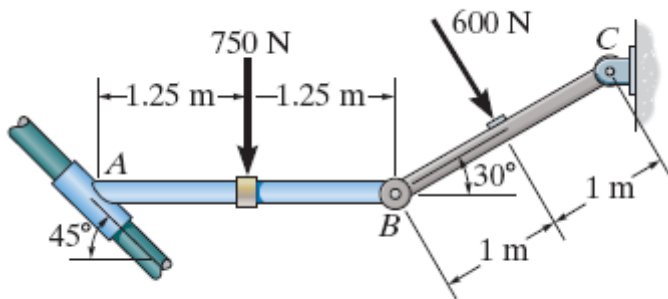
13- Determine the required mass of the suspended cylinder if the tension in the chain wrapped around the freely turning gear is to be 2 kN. Also, what is the magnitude of the resultant force on pin  $A$ ?

( $m = 366$  kg)



14- Determine the reactions on the collar at  $A$  and the pin at  $C$ . The collar fits over a smooth rod, and rod  $AB$  is fixed connected to the collar.

( $N_A = 3.67 \text{ kN}$ ,  $C_x = 2894.13 \text{ N}$ ,  $C_y = 1324.52 \text{ N}$ ,  $M_A = 5547.84 \text{ N m}$  )



15- The double link grip is used to lift the beam. If the beam weighs  $8 \text{ kN}$ , determine the horizontal and vertical components of force acting on the pin at  $A$  and the



horizontal and vertical components of force that the flange of the beam exerts on the jaw at  $B$ .

( $B_y = 4 \text{ kN}$ ,  $B_x = 8 \text{ kN}$ ,  $A_x = 12 \text{ kN}$ ,  $A_y = 0$ )

