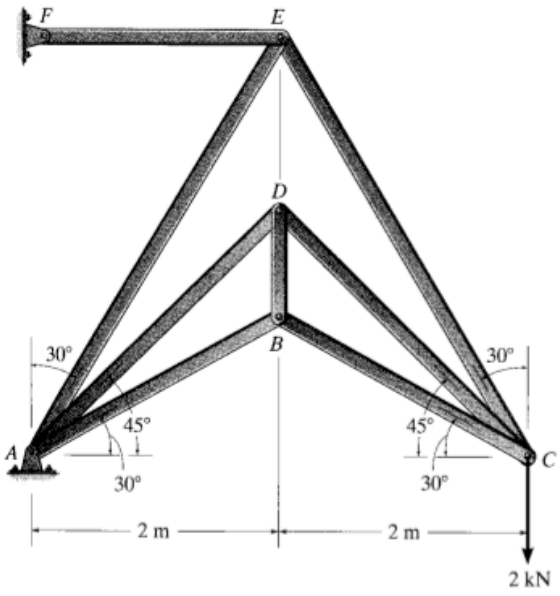
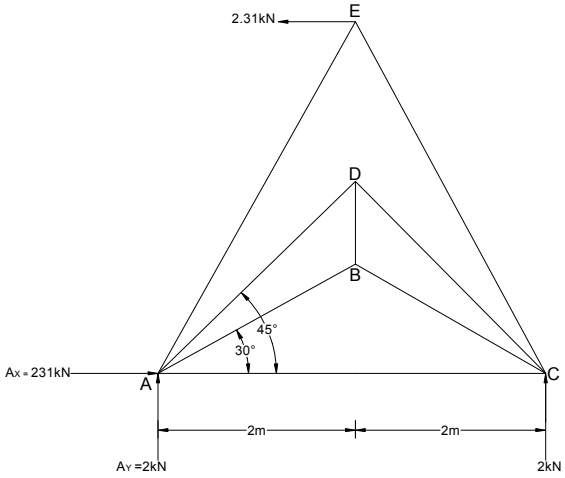
CE 371.02 – Structural Analysis I
Homework #4 Solutions

3–14. Determine the force in each member of the truss. State if the members are in tension or compression.

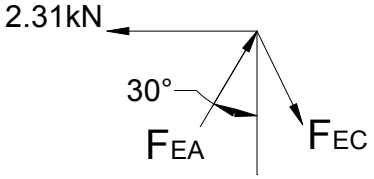


Prob. 3–14

Sol:



Joint E:



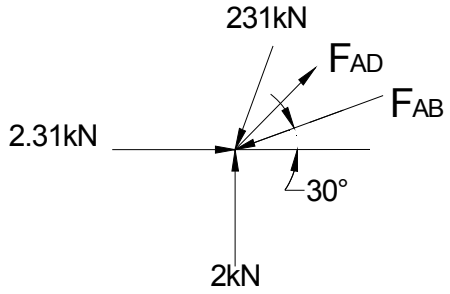
$+\uparrow \Sigma F_Y = 0;$ $F_{EA} = F_{EC}$

$+\rightarrow \Sigma F_X = 0;$ $2.31 - 2F_{EA} \sin 30° = 0$

$F_{EA} = 2.31$ kN (C) **Ans** (2 Points)

$F_{EC} = 2.31$kN (T) **Ans** (1 Point)

Joint A:



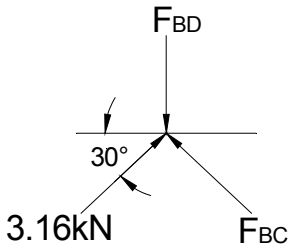
$+\rightarrow \Sigma F_X = 0;$ $2.31 - 2.31 \sin 30° - F_{AB} \cos 30° + F_{AD} \cos 45° = 0$

$+\uparrow \Sigma F_Y = 0;$ $2 - 2.31 \sin 30° + F_{AD} \sin 45° - F_{AB} \sin 30° = 0$

$F_{AD} = 2.24$kN (T) **Ans** (2 Points)

$F_{AB} = 3.16$kN (C) **Ans** (1 Point)

Joint B:

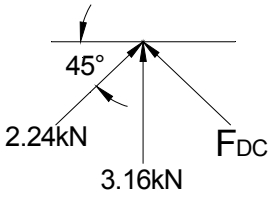


$+\rightarrow \Sigma F_X = 0;$ $F_{BC} = 3.16$kN (C) **Ans** (Point 1)

$+\uparrow \Sigma F_Y = 0;$ $2(3.16) \sin 30° - F_{BD} = 0$

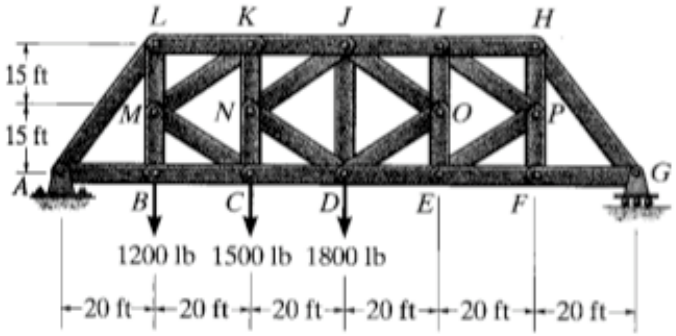
$F_{BD} = 3.16$kN (C) **Ans** (2 Points)

Joint D:



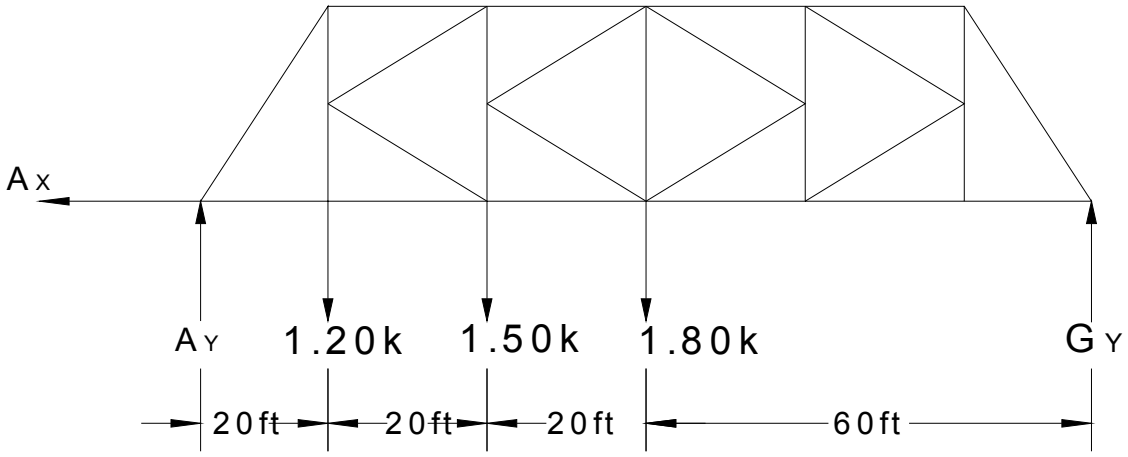
$F_{DC} = 2.24$ (T) **Ans** (Point 1)

***3–44.** Determine the force in members *KJ, NJ, ND*, and *CD* of the *K truss*. Indicate if the members are in tension or compression.



Prob. 3–44

Sol:



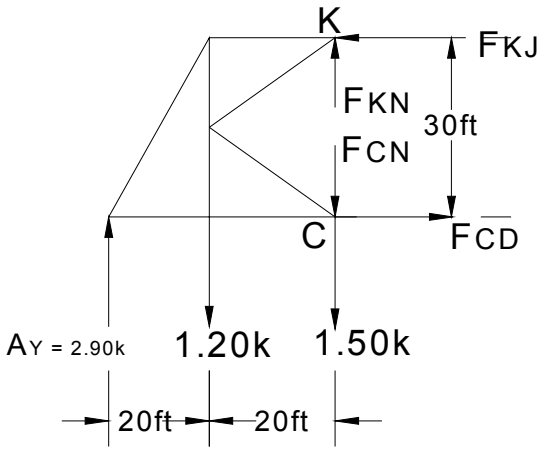
Support Reactions:

$\circlearrowleft + \Sigma M_G = 0;$ $\quad 1.20(100) + 1.50(80) + 1.80(60) - A_Y\,(120) = 0$

$A_Y = 2.90k$

$\rightarrow + \Sigma F_X = 0;$ $\quad A_X = 0$

Method of Section: From section a-a_1, FKJ and FCD can be obtained directly by summing moment about points C and K respectively.



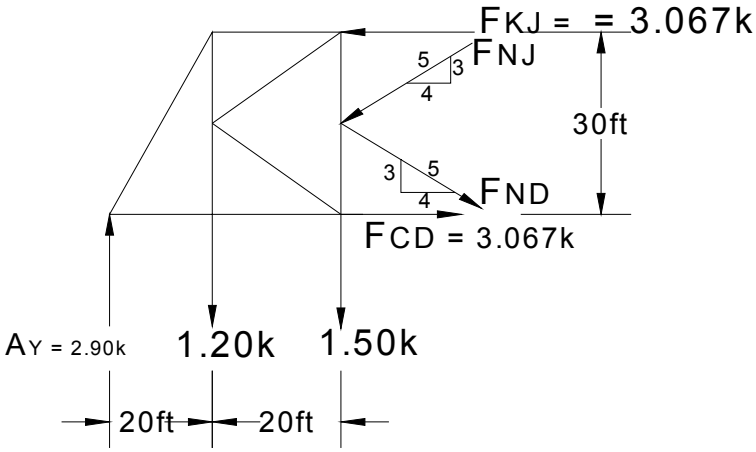
$\circlearrowleft + \Sigma M_C = 0;$ $F_{KJ}(30) + 1.20(20) - 2.90(40) = 0$

$F_{KJ} = 3.067k$ (C) **Ans** (3 Points)

$\circlearrowleft + \Sigma M_K = 0;$ $F_{CD}(30) + 1.20(20) - 2.90(40) = 0$

$F_{CD} = 3.067k$ (T) **Ans** (3 Points)

From sec b-b, summing forces along x and y axes yields



$\rightarrow + \Sigma F_X = 0;$ $F_{ND}(4/5) - F_{NJ}(4/5) + 3.067 - 3.067 = 0$

$F_{ND} = F_{NJ}$ (1)

$\uparrow + \Sigma F_Y = 0;$ $2.90 - 1.20 - 1.50 - F_{ND}(3/5) - F_{NJ}(3/5) = 0$

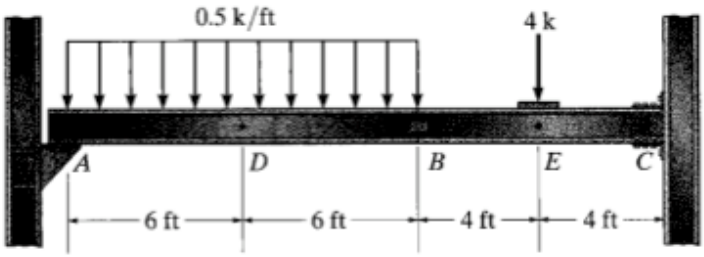
$F_{ND} + F_{NJ} = 0.3333$ (2)

Solving (1) and (2) yields

$F_{ND} = 0.167k$ (T) $F_{NJ} = 0.167k$ (C) **Ans** (4 Points)

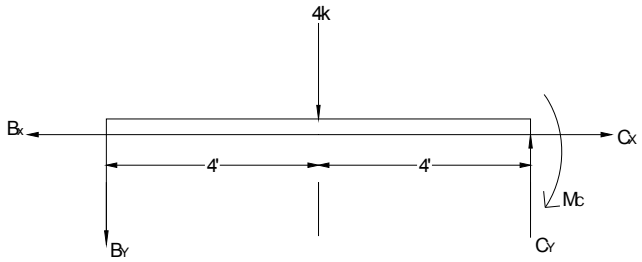
4–10. Determine the internal shear, axial load, and bending moment in the beam at points *D* and *E*. Point *E* is just to the right of the 4-k load. Assume *A* is a roller support, the splice at *B* is a pin, and *C* is a fixed support.

4–11. Draw the shear and moment diagrams for the beam in Prob. 4–10.



Probs. 4–10/4–11

Sol:
Reactions:



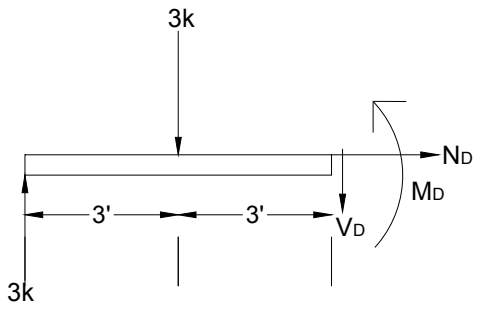
$\rightarrow + \Sigma F_X = 0;$ $\quad B_X = C_X = 0$

$\circlearrowleft + \Sigma M_B = 0;$ $\quad 12A_Y - 6(6) = 0;\ A_Y = 3k$

$+ \uparrow \Sigma F_Y = 0;$ $\quad 3 - 6 + B_Y = 0;\ B_Y = 3k$
$-3 - 4 + C_Y = 0;\ C_Y = 7k$

$\circlearrowleft + \Sigma M_C = 0;$ $\quad -3(8) - 4(4) + M_C = 0;\quad M_C = 40k.ft$

For D:



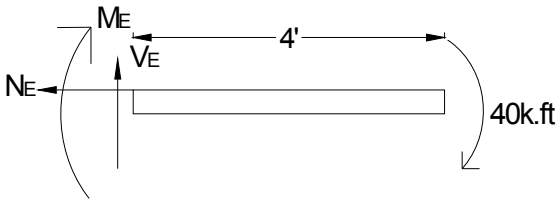
$+\Sigma F_X = 0;$ $N_D = 0$ **Ans** (Point 1)

$+\uparrow \Sigma F_Y = 0;$ $3 - 3 - V_D = 0;$ $V_D = 0$ **Ans** (2 Points)

$\circlearrowleft + \Sigma M_D = 0;$ $3(6) - 3(3) - M_D = 0$

$M_D = 9k.ft$ **Ans** (2 Points)

For E:



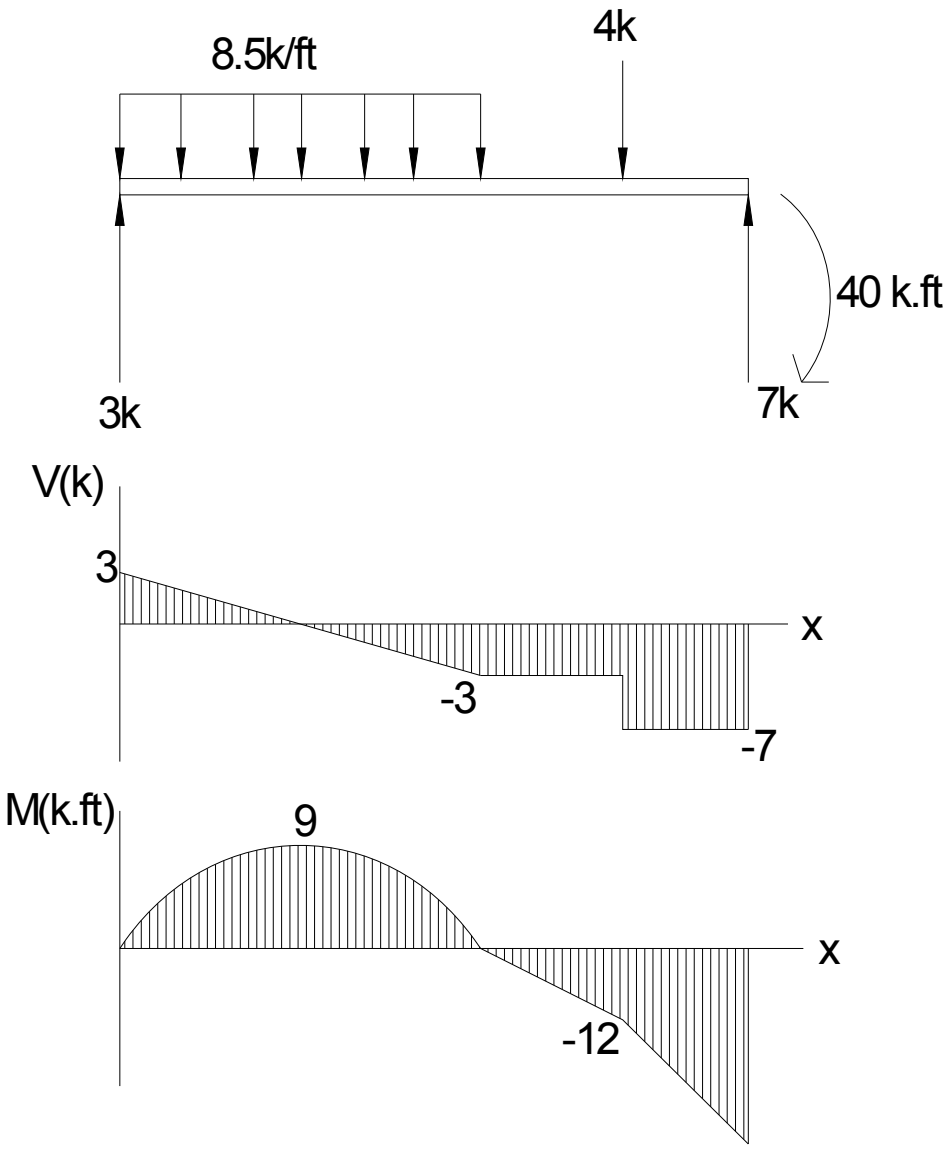
$+\Sigma F_X = 0;$ $N_E = 0$ **Ans** (Point 1)

$+\uparrow \Sigma F_Y = 0;$ $V_E + 7 = 0;$ $V_E = -7k$ **Ans** (2 Points)

$\circlearrowleft + \Sigma M_E = 0;$ $M_E - 7(4) + 40 = 0;$ $M_E = -12k.ft$ **Ans** (2 Points)

4 - 11:

Sol:
Shear Force and Bending Moment Diagram:



(Shear Force Diagram - 5 Points)
(B.M. Diagram - 5 Points)