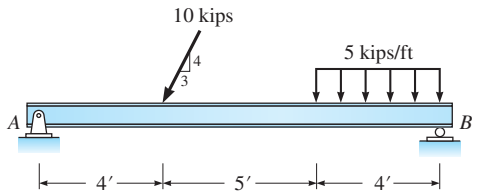
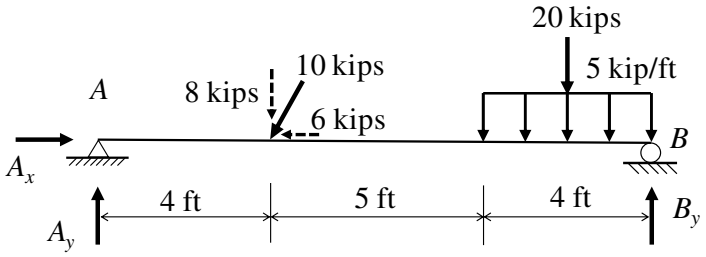
P3.1. Determine the reactions for the structure.



P3.1



$\overset{+}{\circlearrowleft}\Sigma M_A = 0;$

$8^k(4') + 20^k(11') - B_y 13' = 0$

$\boxed{B_y = 19.38 \text{ kips} \uparrow}$

$\overset{\rightarrow +}{\Sigma F_x} = 0;$

$A_x - 6^k = 0$

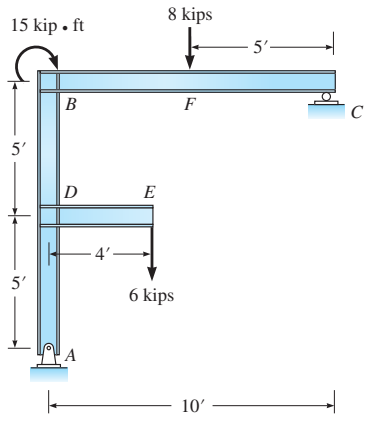
$\boxed{A_x = 6^k \rightarrow}$

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

$A_y - 8^k - 20^k + 19.38^k = 0$

$\boxed{A_y = 8.62^k \uparrow}$

P3.2. Determine the reactions for the structure.



P3.2

$\overset{\circlearrowleft}{+}\Sigma M_A = 0;$

$15^{\text{ft}\cdot\text{k}} + 8^k(5') + 6^k(4') - C_y(10') = 0$

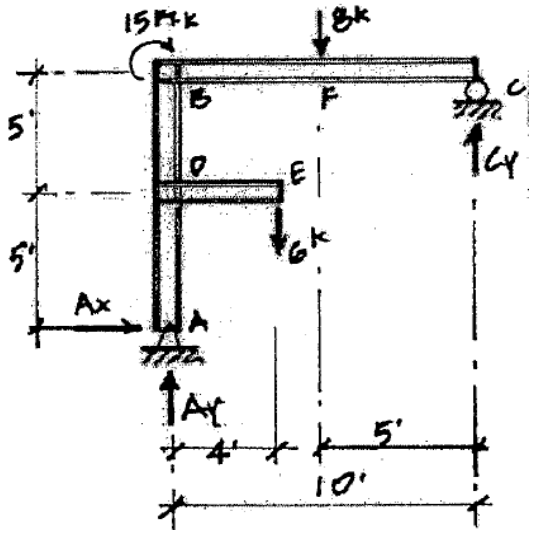
$$\boxed{C_y = 8.5^k \uparrow}$$

$+\uparrow \Sigma F_y = 0;$

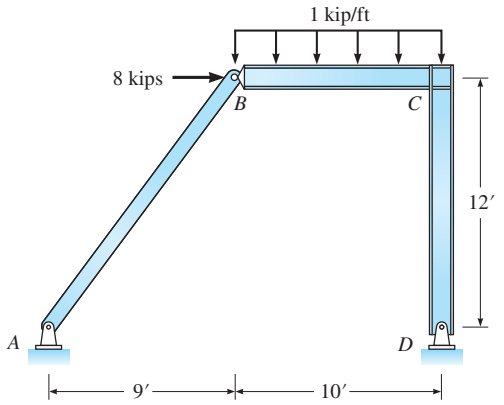
$-8^k - 6^k + 8.5^k + A_y = 0$

$$\boxed{A_y = 5.5^k \uparrow}$$

$\overset{+}{\rightarrow}\Sigma F_x = 0;$ $\quad \boxed{A_x = 0}$



P3.6. Determine the reactions for the structure.



P3.6

$\overset{+}{\circlearrowleft}\Sigma M_A = 0; \quad 8\times12+10\times14-D_y(19)=0$

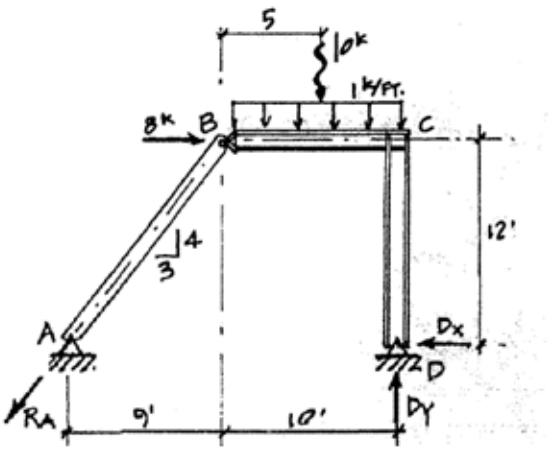
$$\boxed{D_y = 12.42 \text{ kips} \uparrow}$$

$\overset{+}{\uparrow}\Sigma F_y = 0; \quad \frac{4}{5}(-R_A)+12.42-10=0$

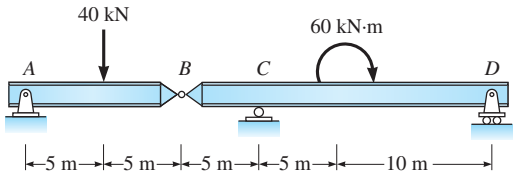
$$\boxed{R_A = 3.025 \text{ kips} \swarrow}$$

$\overset{+}{\rightarrow}\Sigma F_x = 0; \quad \frac{3}{5}(-3.025)-D_x+8=0$

$$\boxed{D_x = 6.185 \text{ kips} \leftarrow}$$



P3.8. Determine the reactions at all supports and the force transmitted through the hinge at *B*.

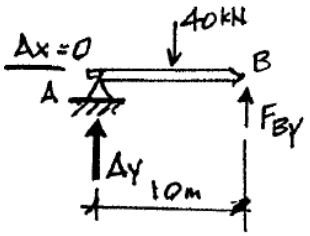


P3.8

FBD "AB"

$A_y = F_{by} = 20$ kN

B_y Symmetry.

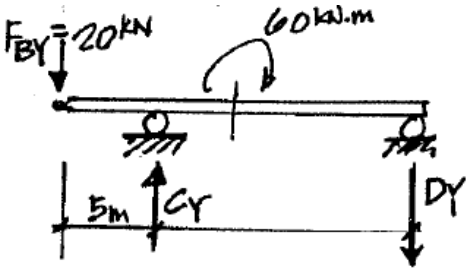


FBD "BCD"

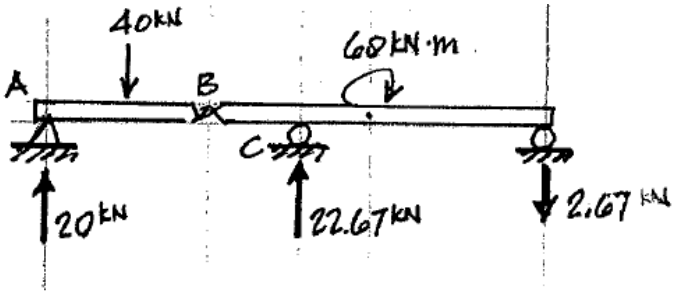
$\overset{\curvearrowleft}{+}\Sigma M_d = 0;$

$-20^{\text{kN}}(5m) + 60 \text{ kN} + D_y(15m) = 0 \qquad D_y = 2.67 \text{ kN} \downarrow$

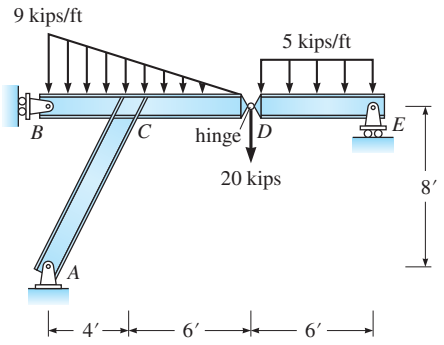
$+\uparrow \Sigma F_y = 0; \qquad -20 + C_y - 2.67 = 0 \qquad C_y = 22.67 \text{ kN} \uparrow$



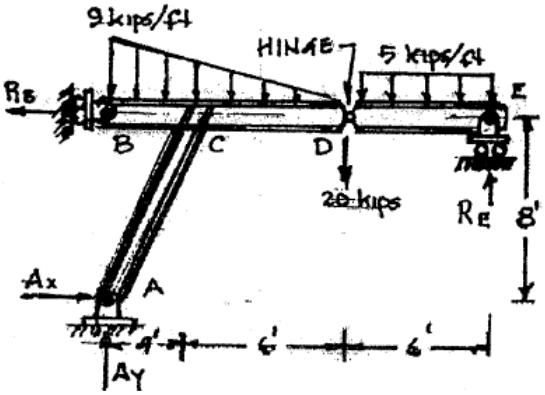
Entire Structure



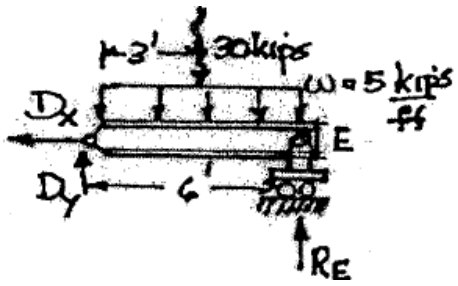
P3.10. Determine the reactions for the structure. All dimensions are measured from the centerlines of members.



P3.10



Freebody Diagram Right of Hinge D:



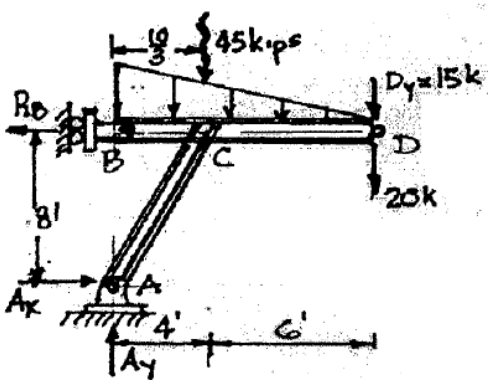
$\overset{\curvearrowright +}{\Sigma M_d = 0;}$ $\quad 30^k(3') - R_e 6' = 0$

$\boxed{R_e = 15 \text{ kips} \uparrow}$

$\overset{+}{\uparrow} \Sigma F_y = 0;$ $\quad D_y - 30^k + R_e - 15^k = 0$

$\boxed{D_y = 15 \text{ kips} \uparrow}$

Freebody Diagram Left of Hinge:



$\overset{\curvearrowright +}{\Sigma M_A = 0;}$ $\quad -R_b 8' + 45^k\left(\frac{10'}{3}\right) + 35^k(10') = 0$

$\boxed{R_b = 62.5 \text{ kips} \leftarrow}$

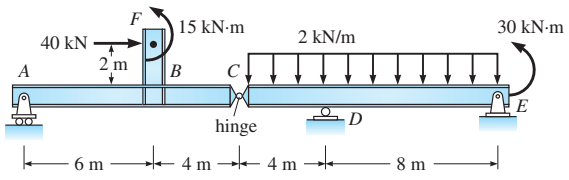
$\overset{\rightarrow +}{\Sigma F_x = 0;}$ $\quad A_x - R_b = 0$

$\boxed{A_x = 62.5 \text{ kips} \rightarrow}$

$\overset{+}{\uparrow} \Sigma F_y = 0;$ $\quad A_y - 45^k - 15^k - 20^k = 0$

$\boxed{A_y = 80 \text{ kips} \uparrow}$

P3.14. Determine the reactions at all supports and the force transmitted through the hinge at *C*.



P3.14

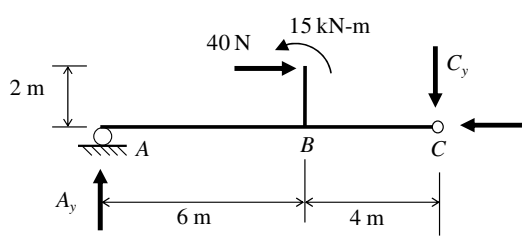


Figure (*a*)

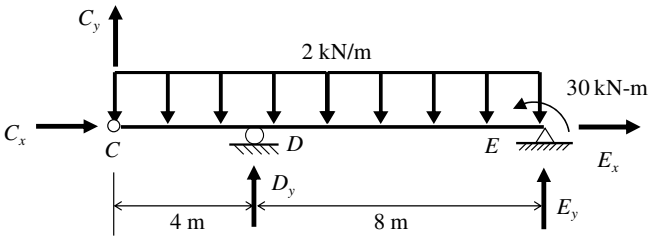


Figure (*b*)

Figure (*a*):

$$\Sigma M_A = -15 + 2(40) + 10C_y = 0$$

$$\boxed{C_y = -6.5 \text{ kips} \uparrow}$$

$$\Sigma F_y = A_y - C_y = 0$$

$$\boxed{A_y = -6.5 \text{ kips} \downarrow}$$

$$\Sigma F_x = 40 - C_x = 0$$

$$\boxed{C_x = 40 \text{ kips} \leftarrow}$$

Figure (*b*):

$$\Sigma M_e = -30 - 6(2)(12) + 8D_y + 12C_y = 0$$

$$\boxed{D_y = 31.5 \text{ kips} \uparrow}$$

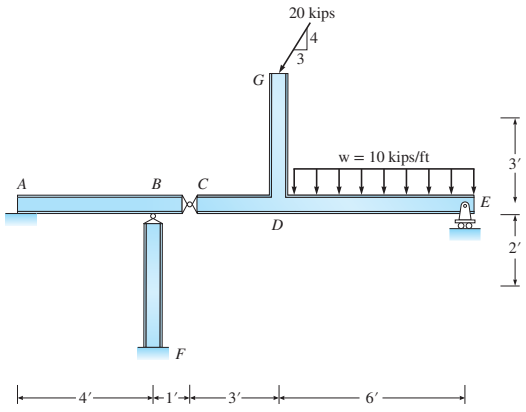
$$\Sigma F_y = D_y + C_y - 12(2) + E_y = 0$$

$$\boxed{E_y = -1 \text{ kips} \downarrow}$$

$$\Sigma F_x = C_x + E_x = 0$$

$$\boxed{E_x = -40 \text{ kips} \leftarrow}$$

P3.26. Compute the reactions at supports A, E, and F.



P3.26

Figure (b):

$$\Sigma M_C = -20\left(\frac{3}{5}\right)3+20\left(\frac{4}{5}\right)3+10(6)6-9E_y = 0$$

$$\boxed{E_y = 41.33 \text{ kips} \uparrow}$$

$$\Sigma F_y = E_y - 6(10) - 20\left(\frac{4}{5}\right) + C_y = 0$$

$$C_y = 34.67 \text{ kips}$$

$$\Sigma F_x = C_x - 20\left(\frac{3}{5}\right) = 0$$

$$C_x = 12 \text{ kips}$$

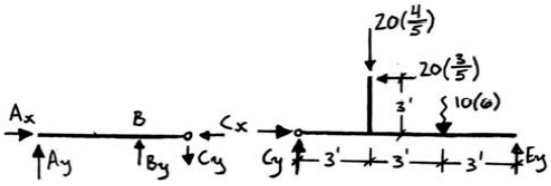


Figure (a) Figure (b)

Figure (c)

Figure (a):

$$\Sigma M_A = -4B_y + C_y(5) = 0$$

$$\boxed{B_y = 43.33 \text{ kips} \uparrow}$$

$$\Sigma F_y = A_y + B_y - C_y = 0$$

$$\boxed{A_y = -8.66 \text{ kips} \downarrow}$$

$$\Sigma F_x = A_x - C_x = 0$$

$$\boxed{A_x = 12 \text{ kips} \rightarrow}$$

Figure (c):

$$\Sigma F_y = F_y - B_y = 0$$

$$\boxed{F_y = 43.33 \text{ kips} \uparrow}$$