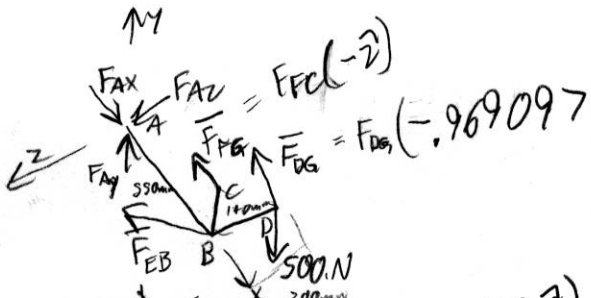
PSS solutions

① $\vec{M} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 220mm & 105mm & 82.0mm \\ 25.0N & -10.0N & 40.0N \end{vmatrix} = \boxed{5.02N\cdot m\hat{i} - 6.75N\cdot m\hat{j} - 4.83N\cdot m\hat{k}}$

② $\vec{M} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 72.0in & -10.5in & -28.0in \\ -15.0lb & 20.0lb & 10.0lb \end{vmatrix} = \boxed{455in\cdot lb\hat{i} - 300in\cdot lb\hat{j} + 1283in\cdot lb\hat{k}}$

③



$\vec{F}_{FC} = F_{FC}(-\hat{i})$

$\vec{F}_{DG} = F_{DG}(-.96909\hat{i} + .24668\hat{j})$

$\vec{F}_{EB}(-.93979\hat{i} + .34174\hat{k})$

$\Sigma M_{AX} = 0 = 300mm(.24668F_{DG}) - 500N(300mm)$

$\boxed{F_{DG} = 2026.9\ N}$

$\Sigma M_{AZ} = 0 = F_{FC}(140mm) - 500N(550mm) + .24668F_{DG}(550mm)$

$\rightarrow \boxed{F_{FC} = 785.7N}$

$\Sigma M_{AY} = 0 = F_{DG}(.96909)(200mm) - F_{EB}[(200mm)(.93979) + (550mm)(.34174)]$

$0 = F_{DG}(290.73m) \qquad -375,915F_{EB}\cdot mm \rightarrow \boxed{F_{BE} = 1567.6N}$

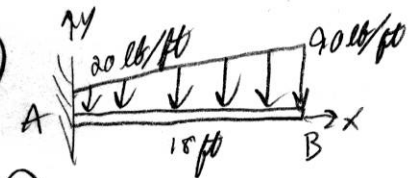
$\Sigma F_X = F_{AX} - F_{EB}(.93979) - F_{FC} - F_{DG}(.96909) = 0$

$\rightarrow \boxed{F_{AX} = 4223.2N}$

$\Sigma F_Y = 0 = -500N + F_{AY} + (.24668)F_{DG} \rightarrow \boxed{F_{AY} = 0\ N}$

$\Sigma F_Z = 0 = F_{AZ} + F_{BE}(.34174) \rightarrow \boxed{F_{AZ} = -535.7N}$

(4)



centroid: 20 lb/ft (18 ft) at 9.0 ft

$\frac{1}{2}(70\ lb/ft)18\ ft$ at 12.0 ft

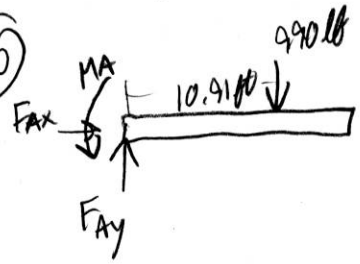
$$\bar{x} = \frac{(9.0\ ft)(20\ lb/ft)(18\ ft) + (\frac{1}{2})70\ lb/ft(12\ ft)(18\ ft)}{20\ lb/ft(18\ ft) + (\frac{1}{2})70\ lb/ft(18\ ft)}$$

$$\boxed{\bar{x} = 10.91\ ft}$$

(a) load: $20\ lb/ft\ (18.0\ ft) + \frac{1}{2}(70\ lb/ft)18\ ft$

$$= \boxed{990\ lb}$$

(b)



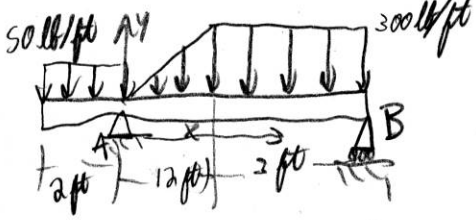
$$\circlearrowright \Sigma M_A = 0 = M_A - 10.91\ ft(990\ lb)$$

$$\rightarrow \boxed{M_A = 10{,}800\ ft \cdot lb}$$

$$\Sigma F_y = 0 = F_{Ay} - 990\ lb \rightarrow \boxed{F_{Ay} = 990\ lb}$$

($F_{Ax} = 0$ - trivial)

(5)



100 lb at -1 ft

1800 lb at 8 ft

900 lb at 13.5 ft.

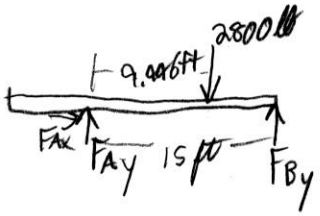
(a) load: $50\ lb/ft(2\ ft) + \frac{1}{2}(300\ lb/ft)12\ ft + 300\ lb/ft(3\ ft)$

$$\boxed{load = 2800\ lb}$$

$$\bar{x} = \frac{100(-1)\ ft \cdot lb + 1800(8)\ ft \cdot lb + 900(13.5)\ ft \cdot lb}{2800\ lb}$$

$$\boxed{\bar{x} = 9.446\ ft} \ (\rightarrow 9.45\ ft)$$

(b)



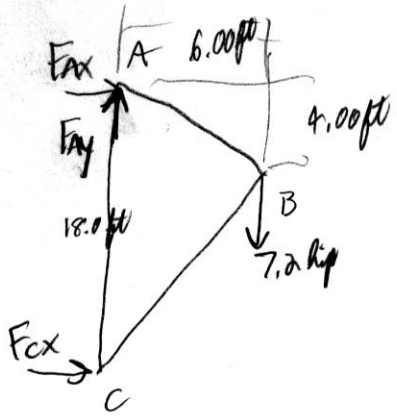
$$\Sigma M_A = 0 = -2800\ lb(9.446\ ft) + F_{By}(15\ ft)$$

$$F_{By} = 1763.25\ lb \rightarrow \boxed{1760\ lb}$$

$$\Sigma F_y = 0 = F_{By} - 2800\ lb + F_{Ay} \rightarrow \boxed{F_{Ay} = 1036.7\ lb \rightarrow 1040\ lb}$$

($F_{Ax} = 0$ - trivial)

(6)



body: $\Sigma M_A = 0 = F_{cx}(18.0\,ft) - 7.2\,kip(6.00\,ft)$

$\rightarrow \boxed{F_{cx} = 2.4\,kip}$

at C:

$\Sigma F_x = \frac{6}{15.2315}(CB) + 2.4\,kip$

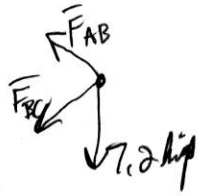
$\rightarrow CB = -6.0926\,kip$

$\boxed{CB \rightarrow 6.1\,kip}$

$\Sigma F_y = 0 = AC + CB\left(\frac{14.0}{15.2315}\right)$

$\rightarrow \boxed{AC = 5.60\,kip}$

at B:



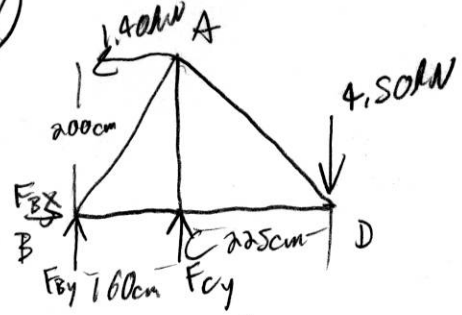
$\Sigma F_x = 0 = -\frac{6}{\sqrt{52}}AB + CB\left(\frac{-6}{15.2315}\right)$

$\rightarrow AB = 2.884\,kip$

$\rightarrow \boxed{AB = 2.9\,kip}$

AB: 2.9 kip (T)
AC: 5.6 kip (T)
BC: 6.1 kip (C)

(7)



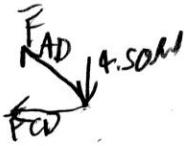
body: $\Sigma F_x = 0 = -1.40kN + F_{BX}$

$\rightarrow F_{BX} = 1.40kN$ (unneeded)

$\Sigma M_B = 0 = F_{Cy}(160cm) + 1.40kN(200cm) - 4.50kN(225cm)$

$\rightarrow F_{Cy} = 4.578kN$

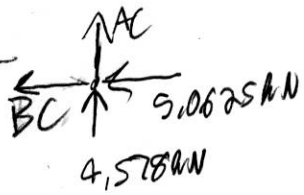
at D:



$\Sigma F_y = 0 = -4.50kN + AD\left(\frac{200}{301.04}\right) \rightarrow AD = 6.7734kN$

$\Sigma F_x = 0 = \frac{225}{301.04} AD - CD \rightarrow CD = -5.0625kN$

at C:



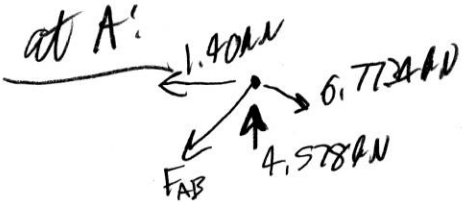
$\Sigma F_x = 0 = -BC - 5.0625kN$

$\rightarrow BC = -5.0625kN$

$\Sigma F_y = 0 = 4.578kN + AC$

$\rightarrow AC = -4.578kN$

at A:



$\Sigma F_x = 0 = 6.7734kN\left(\frac{225}{301.04}\right) - 1.40kN - AB\left(\frac{160}{256.125}\right)$

$\rightarrow AB = 5.863kN$

AB: 5.86kN(T)
AC: 4.58kN(C)
AD: 6.77kN(T)
BC: 5.06kN(C)
CD: 5.06kN(C)