

PROB. 6.13  
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STEP ① EXTERNAL

$$\sum F_x = 0 = R_{Ax} \quad \checkmark$$

$$\sum F_y = 0 = R_{Ay} + R_{Ey} - 7.2 \text{ kN}$$

$$\sum M_A = 0 = -2.4 \text{ kN}(6\text{m}) - 2.4 \text{ kN}(12\text{m}) \\ - 1.2 \text{ kN}(18\text{m}) + R_{Ey}(18\text{m})$$

$$\therefore R_{Ey} = \frac{14.4 + 28.8 + 21.6}{18\text{m}}$$

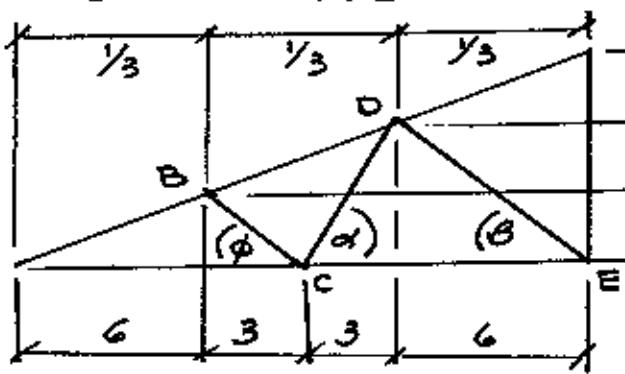
$$R_{Ey} = 3.6 \text{ kN} \uparrow \quad \text{BACK SUB.}$$

$$\therefore R_{Ay} = 3.6 \text{ kN} \uparrow$$

STEP ② INTERNAL

FIRST - GEOMETRY  
SLOPE A-B-D-F

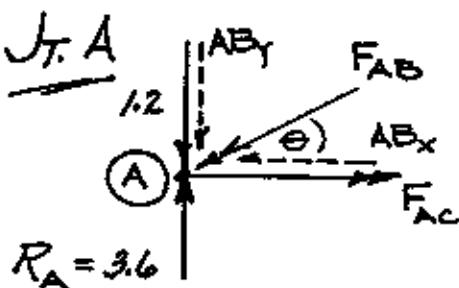
$$\theta = \tan^{-1} \frac{7.5}{18} = 22.62^\circ$$



$$\phi = \tan^{-1} \frac{2.5}{3} = 39.8^\circ \text{ for } \overline{BC}$$

$$\alpha = \tan^{-1} \frac{5.0}{3} = 59.04^\circ \text{ for } \overline{CD}$$

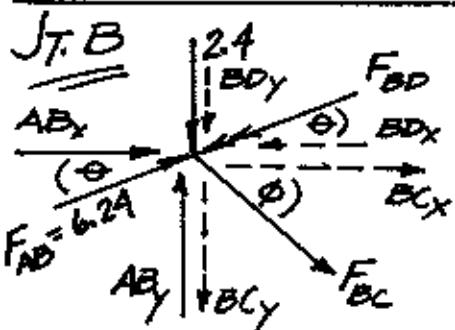
$$\beta = \tan^{-1} \frac{5.0}{6} = 39.8^\circ \text{ for } \overline{DE}$$



$$\sum F_y = 0 = -1.2 - AB \sin 22.62^\circ + 3.6$$

$$F_{AB} = \frac{3.6 - 1.2}{\sin 22.62^\circ} = 6.24 \text{ kN} \quad \checkmark$$

$$\sum F_x = 0 = -AB_x + F_{AC} \Rightarrow F_{AC} = F_{AB} \cos 22.62^\circ = 5.76 \text{ kN T} \quad \checkmark$$



$$\sum F_x = 0 = 6.24 \cos 22.62^\circ - BD_x + BC_x \\ = 5.76 - BD \cos 22.62^\circ + BC \cos 39.8^\circ \\ 0 = 5.76 - .923 BD + .768 BC$$

$$\sum F_y = 0 = -2.4 - BD_y - BC_y + 6.24 \sin 22.62^\circ \\ 0 = -2.4 - BD \sin 22.62^\circ - BC \sin 39.8^\circ + 2.4 \\ 0 = -.385 BD - .64 BC$$

J.T. B SOLVE SIMULT.

$$\text{IF } O = - .385 BD - .64 BC$$

THEN

$$BD = \frac{- .64}{.385} BC = - 1.663 BC = BD$$

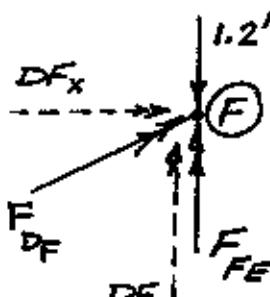
BACK SUB.

$$\sum F_x = 0 = 5.76 - .923[-1.663 BC] + .768 BC$$

$$-5.76 = 2.3 BC \quad \therefore BC = -2.5 \quad \text{or} \quad F_{BC} = 2.5 \text{ kN C} \checkmark$$

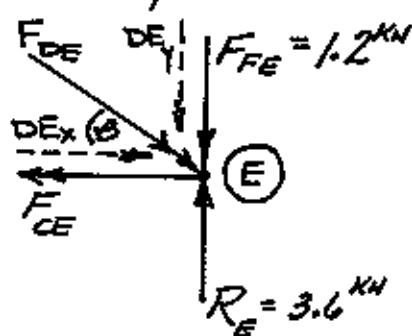
$$\therefore BD = -1.663[-2.5] = +4.16$$

$$\therefore F_{BD} = 4.16 \text{ kN C} \checkmark$$

SKIP OVER TO J.T. F FOR SOMETHING INTERESTING.

$$\sum F_x = 0 = DF_x ? \quad \text{So } F_{DF} = 0$$

$$\text{THEN } \sum F_y = 0 = -1.2 + F_{FE} \quad F_{FE} = 1.2 \text{ kN C} \checkmark$$

MOVE DOWN TO J.T. E

$$\sum F_y = 0 = -DE_y - 1.2 + 3.6$$

$$DE \sin 39.8^\circ = 2.4$$

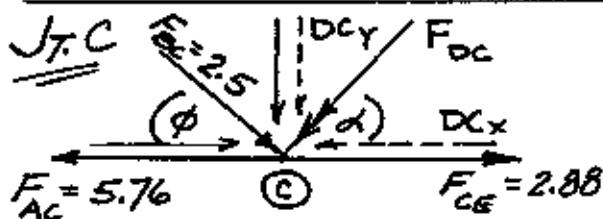
$$DE = 3.75$$

$$\therefore F_{DE} = 3.75 \text{ kN C} \checkmark$$

$$\sum F_x = 0 = DE_x - F_{CE}$$

$$3.75 \cos 39.8^\circ = F_{CE}$$

$$\therefore F_{CE} = 2.88 \text{ kN T} \checkmark$$

ONLY ONE UNKNOWN  
EITHER EQ. WOULD WORK.

$$\sum F_x = 0 = -5.76 + 2.5 \cos 39.8^\circ + 2.88 - DC \cos 59.04^\circ$$

$$\frac{- .96}{\cos 59.04^\circ} = DC = - 1.86$$

$$\therefore F_{DC} = 1.86 \text{ kN T} \checkmark$$

$$\sum F_y = 0 = -2.5 \sin 39.8^\circ - DC \sin 59.04^\circ$$

$$\frac{- 1.6}{\sin 59.04^\circ} = DC = - 1.866$$

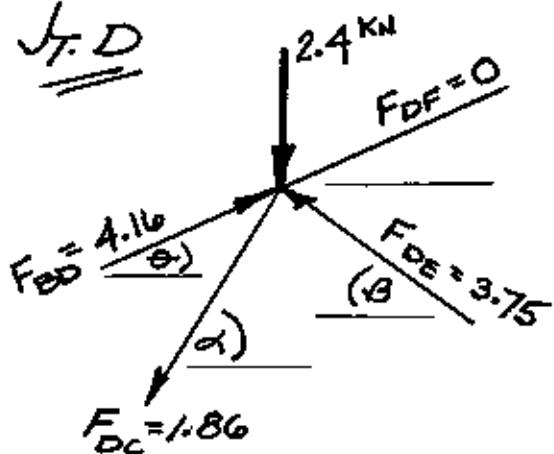
$$\therefore F_{DC} = 1.86 \text{ kN T}$$

agrees

Now DO THE LAST JOINT AS A CHECK!

J.T. D

J.T.D



Prob. 6.13

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$$\begin{aligned}\theta &= 22.62^\circ \\ \alpha &= 59.04^\circ \\ \beta &= 39.8^\circ\end{aligned}$$

$$\begin{aligned}\sum F_x = 0 &= 4.16 \cos 22.62^\circ - 1.86 \cos 59.04^\circ - 3.75 \cos 39.8^\circ \\ &= 3.84 - .957 - 2.88 \\ &= 0.0019 \quad \text{okay}\end{aligned}$$

$$\begin{aligned}\sum F_y = 0 &= -2.4 + 4.16 \sin 22.62^\circ - 1.86 \sin 59.04^\circ + 3.75 \sin 39.8^\circ \\ &= -2.4 + 1.6 - 1.595 + 2.4 \\ &= 0 \quad \text{yep, it checks!}\end{aligned}$$

### SUMMARY

MEMBER	INTERNAL FORCE KN	
AB	6.24	C
AC	5.76	T
BC	2.5	C
BD	4.16	C
DC	1.86	T
CE	2.88	T
DF	0	
DE	3.75	C
FE	1.2	C