R8 solutions

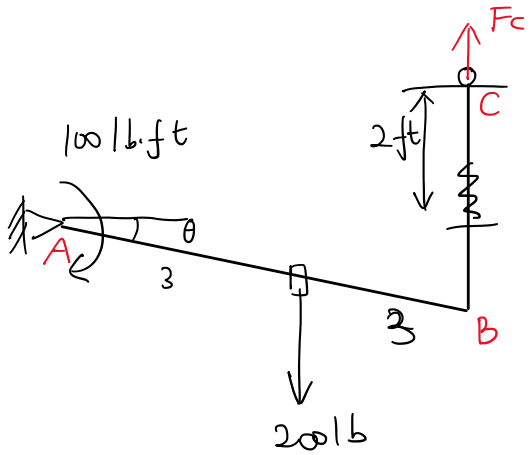
2024年2月22日 星期四　　上午11:26

(1) $\vec{M} = \vec{r} \times \vec{F}$

$\vec{r} = (1, -2, 6)\,m \quad \vec{F} = (-6, 4, 8)\,kN$

$$\vec{r} \times \vec{F} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 1 & -2 & 6 \\ -6 & 4 & 8 \end{vmatrix} = -40\vec{i} - 44\vec{j} - 8\vec{k} \quad kN \cdot m$$

(2)



$\vec{M}$ @ A:

$$200 \times 3\cos\theta + 100 = F_c \cdot (3+3)\cos\theta$$

$$F_c = \frac{600\cos\theta + 100}{6\cos\theta} = 100 + \frac{100}{6\cos\theta}$$

$$\Delta L = \frac{F_c}{k} = \frac{F_c}{50} = 2 + \frac{1}{3\cos\theta}$$

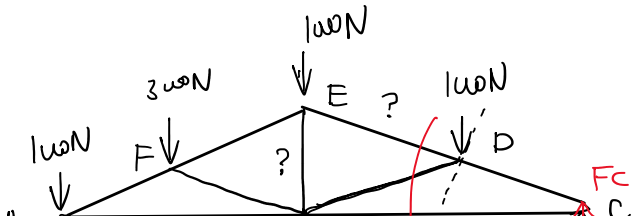
$$|\vec{BC}| = 2 + \left(2 + \frac{1}{3\cos\theta}\right) = 2 + 6\sin\theta$$

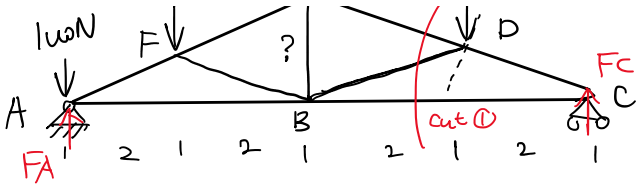
$$2 + \frac{1}{3\cos\theta} = 6\sin\theta$$

$$6\cos\theta + 1 = 18\sin\theta\cos\theta = 9\sin(2\theta)$$

↳ $\theta^\circ = 23.2^\circ$ or 85.2°

(3)



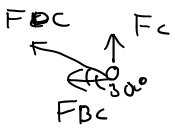


$\vec{M}$ @ A: $3000 \times 2 + 1000 \times 4 + 1000 \times 6 = F_C \times 8$

$F_C = 2000\,N$

$F_A = 1000 + 3000 + 1000 + 1000 - 2000 = 4000\,N$

Equilirum @ C:



$\frac{F_{DC}}{2} + 2000 = 0$ $\qquad F_{DC} = -4000$

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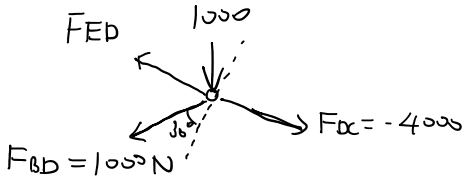
$\vec{M}$ @ C: $1000 \times 2 + F_{BD} \times 2 = 0$

$F_{BD} = -1000\,N$

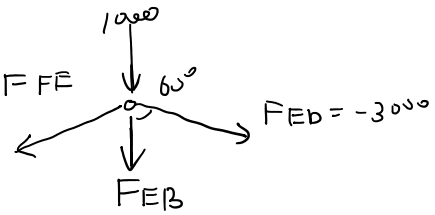
Equibrium @ D



$F_{ED} + \frac{F_{BD}}{2} = \frac{1000}{2} + (-4000)$

$F_{ED} = -3000\,N$ (Compression)

Equibrium @ E



From $\Sigma F_x = 0 \Rightarrow F_{FE} = F_{ED}$

ΣF_y: $1000 + \frac{2F_{ED}}{2} + F_{EB} = 0$

$F_{EB} = -1000 - \frac{2 \times (-3000)}{2}$

$= 500 + 300 = 1300\ N$ (tension)