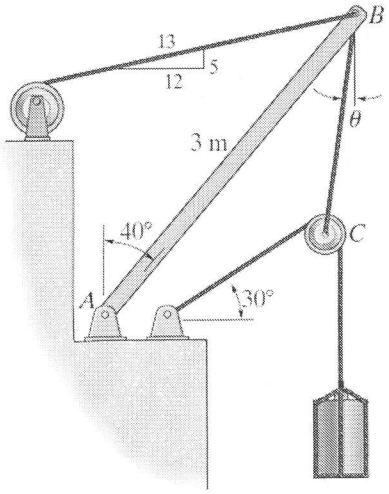
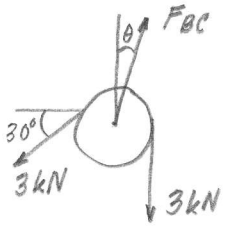
CME 250 – Statics
Exam #7 (11/20/2023)

StarID or TechID (no names) Grading

Show your work (you will not receive any credit if all you have is a final answer, right or wrong).
Do one of the two problems shown below (the second problem is on the back).

1. The crane below is in static equilibrium with the 3 kN container lifted as shown. Determine the force in the cable BC and its orientation θ. Also determine the horizontal and vertical components of force at pin support A.





$\Sigma F_x = 0$,

$-3\,kN\cos 30° + F_{BC}\sin\theta = 0$

$F_{BC}\sin\theta = 2.598\,kN$ (1)

$\Sigma F_y = 0$,

$-3\,kN\sin 30° - 3\,kN + F_{BC}\cos\theta = 0$

$F_{BC}\cos\theta = 4.5\,kN$ (1)

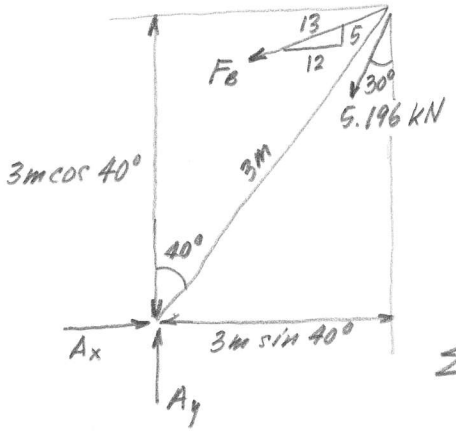
$$\frac{F_{BC}\sin\theta}{F_{BC}\cos\theta} = \frac{2.598\,kN}{4.5\,kN}$$

$\tan\theta = 0.5773$

$\boxed{\theta = 30°}$ (2)

$$F_{BC} = \frac{2.598\,kN}{\sin 30°}$$

$\boxed{F_{BC} = 5.196\,kN \rightarrow 5.20\,kN}$ (1)



$\Sigma M_A = 0$,

$(5.196\,kN)\sin 30°(3m\cos 40°)$

$-(5.196\,kN)\cos 30°(3m\sin 40°)$

$+\left(\frac{12}{13}F_B\right)(3m\cos 40°)$

$-\left(\frac{5}{13}F_B\right)(3m\sin 40°) = 0$

$1.380m\,F_B = 2.707\,kN\cdot m$

$F_B = 1.962\,kN$ (3)

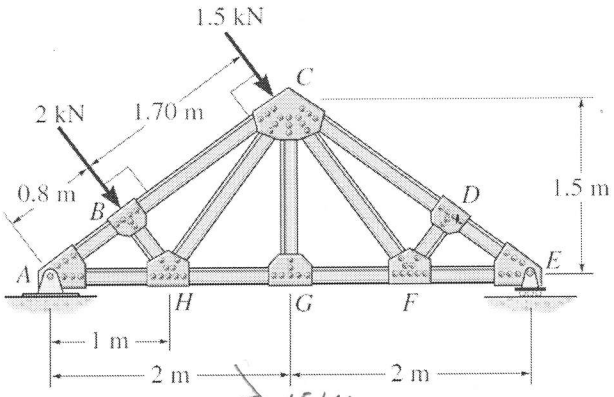
$\Sigma F_x = 0$, $-\frac{12}{13}(1.962\,kN) - 5.196\,kN\sin 30° + A_x = 0$

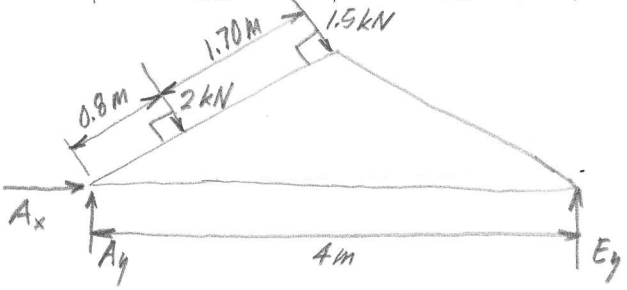
$\boxed{A_x = 4.409\,kN \rightarrow 4.41\,kN}$ (1)

$\Sigma F_y = 0$, $-\frac{5}{13}(1.962\,kN) - 5.196\,kN\cos 30° + A_y = 0$

$\boxed{A_y = 5.254\,kN \rightarrow 5.25\,kN}$ (1)

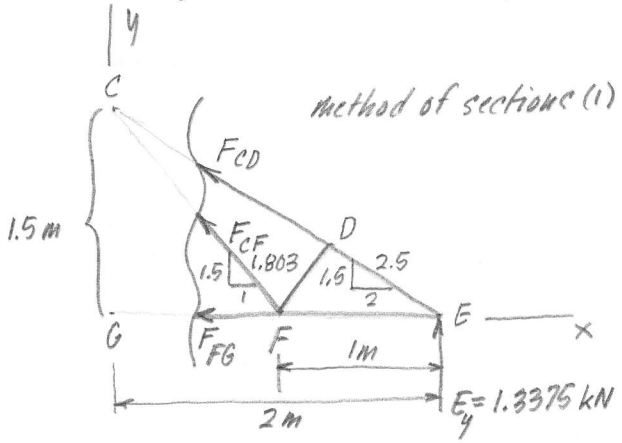
2. Using the method of sections, determine the force in members GF, CF, and CD of the truss and state whether the members are in tension or compression. (the dimensions of the truss are symmetric about its center)





$\sum M_A = 0, \quad -(2\,kN)(0.8\,m) - (1.5\,kN)(2.50\,m) + E_y(4\,m) = 0$

$E_y = 1.3375\,kN$ (3)



$\sum M_C = 0, \quad -F_{FG}(1.5\,m) + (1.3375\,kN)(2\,m) = 0$

$F_{FG} = 1.783\,kN$

or $\boxed{1.78\,kN\,(T)}$ (2)

$\sum M_E = 0, \quad \frac{-1.5}{1.803} F_{CF}(1\,m) = 0$

$\boxed{F_{CF} = 0}$ (2)

$\sum F_x = 0, \quad -1.783\,kN - \frac{2}{2.5} F_{CD} = 0$

$F_{CD} = -2.229\,kN$

or $\boxed{2.23\,kN\,(C)}$

(2)