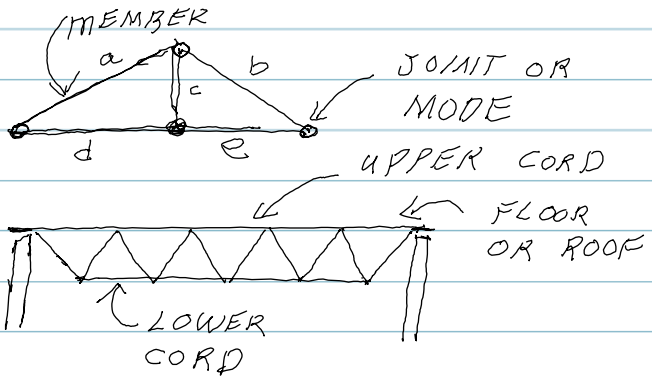
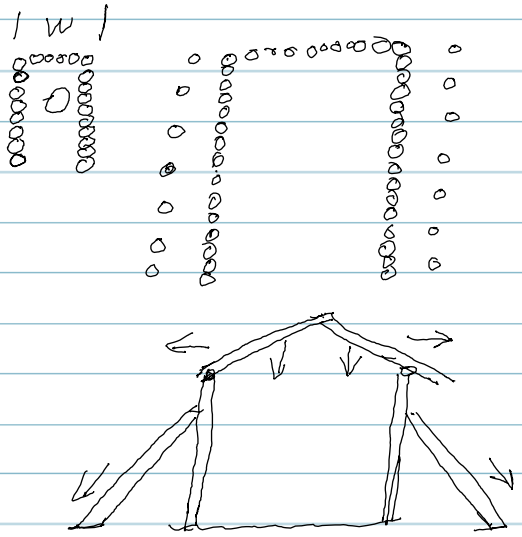
CH 6 SECTION 6.1 STRUCTURES IN EQUILIBRUM

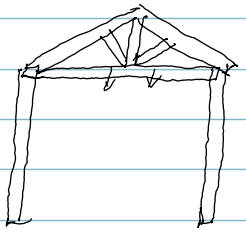
INTRO: TRUSS
FRAMES
MACHINES

6.1 TRUSS - DEVELOPMENT

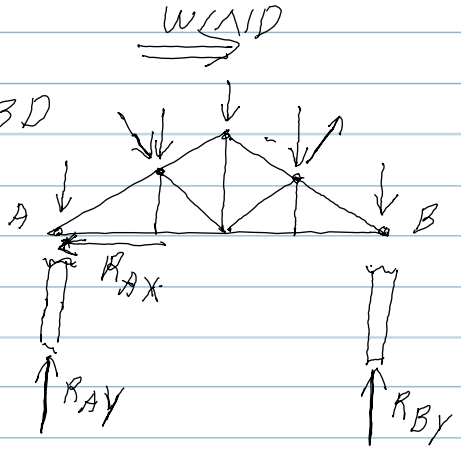




WHY - EFFICIENCY
1) LIGHT WEIGHT
2) HIGH STRENGTH TO WEIGHT RATIO



ANALYSIS -
1) DRAW FBD



2) SOLVE FOR EXTERAL REACTION - R_{AX}, R_{AY}, R_{BY} = ?

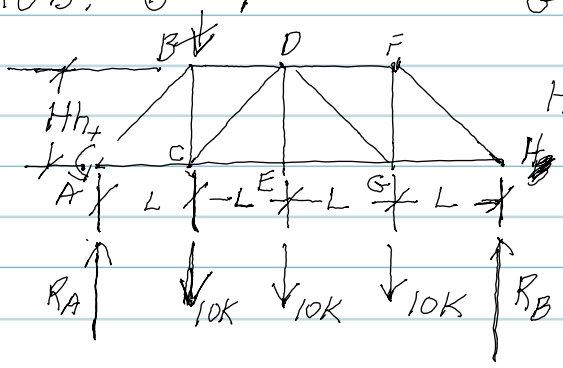
$\Sigma M_A = 0$ - $\Sigma F_x = 0$ $\Sigma F_y = 0$

$\Sigma_A F \circ r_\perp = 0$

CH 6 SECTION 6.2 METHOD OF JOINTS

PROB. 6-9

GIVEN:



HOWE BRIDGE TRUSS
L = 17 FT
H = 8 FT

FIND: LARGEST TENSILE & COMPRESSIVE FORCES IN MEMBERS

SOLUTION: $\Sigma M_A = 0 \Rightarrow -10(17) -10(34) -10(51) +68R_B = 0$

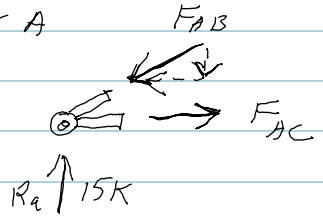
$R_b = 15.$ KIPS

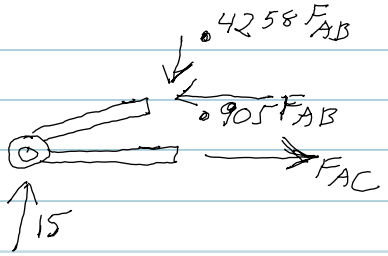
$\Sigma F_y = 0$

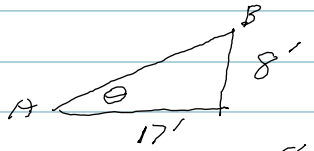
$R_a - 10 - 10 - 10 + 15 = 0 \Rightarrow R_a = 15$ KIPS

METHOD OF JOINTS:

JOINT A







$TAN(\theta) = \frac{8}{17}$

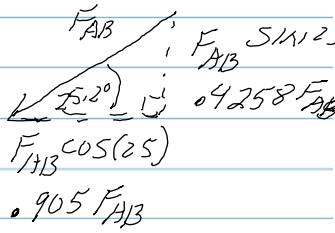
$\theta = 25.2^\circ$

$\Sigma F_y = 0$

$+15 - .4258 F_{AB} = 0$

$.4258 F_{AB} = 15$

$F_{AB} = 35.3$ kips (C)



$\Sigma F_x = 0 \Rightarrow -.905 F_{AB} + F_{AC} = 0$

$-.905(35.3) + F_{AC} = 0$

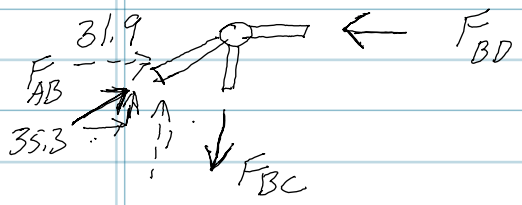
$-31.9 + F_{AC} = 0$

$F_{AC} = 31.9$ KIPS (T)

CH. 6 PROB. 6-9 (CONT.)

JOINT "B" or "C"

JOINT "B"



$\Sigma F_y = 0$

$+31.9 - F_{BD} = 0$

$F_{BD} = 31.9$ KIPS (C)

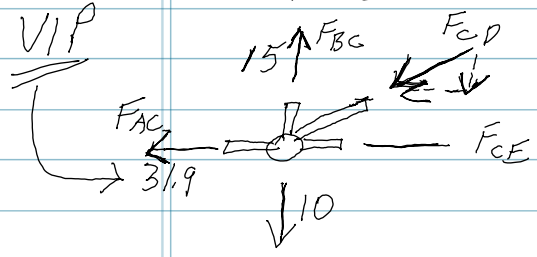
$\Sigma F_y = 0$

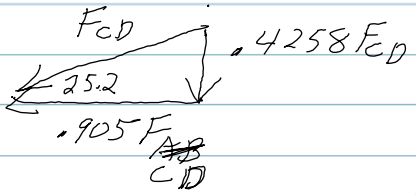
$+15 - F_{BC} = 0$

$F_{BC} = 15$ KIP (T)

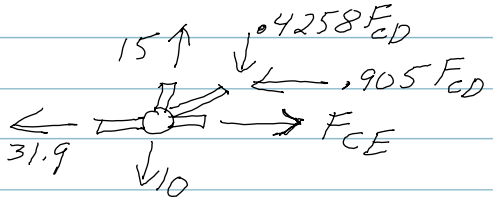
JOINT "C"

VIP





JOINT "C"



$\Sigma F_y = 0$

$+15 - 10 - .4258 F_{CD} = 0$

$F_{CD} = 11.7$ KIPS (C)

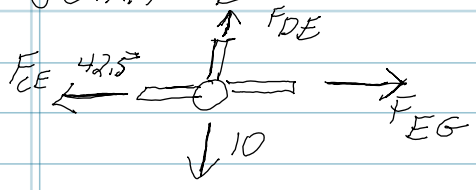
$\Sigma F_x = 0$

$-31.9 - .905 F_{CD} + F_{CE} = 0$

$-31.9 - .905(11.7) + F_{CE} = 0$

$F_{CE} = 42.5$ K (T)

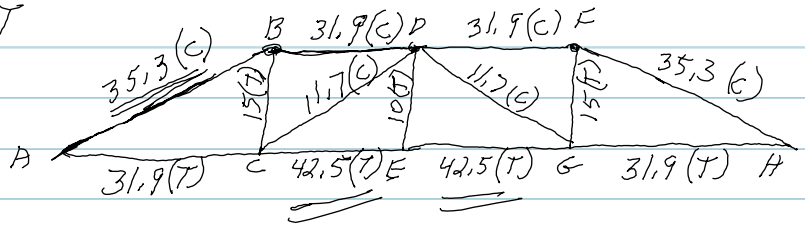
JOINT "E"



$F_{EG} = 42.5$ K (T)

$F_{DE} = 10$ K (T)

LARGEST



TOP CORD ⇒ (C)

BOTTOMS ⇒ (T)

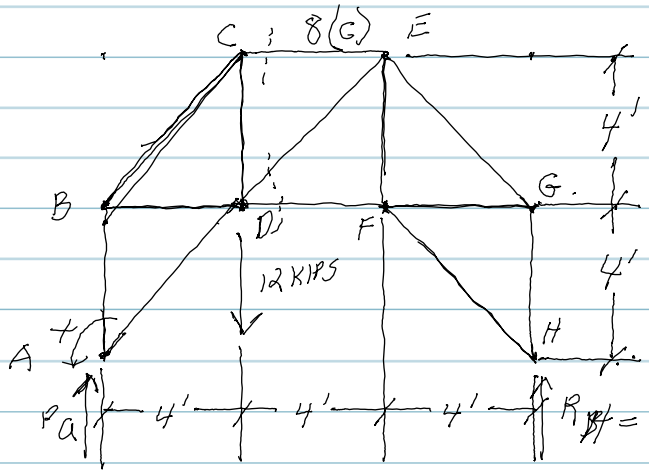
DONE

CH 6 SECTION 6.3 METHOD OF SECTIONS

PROB. 6-49

GIVEN: 1

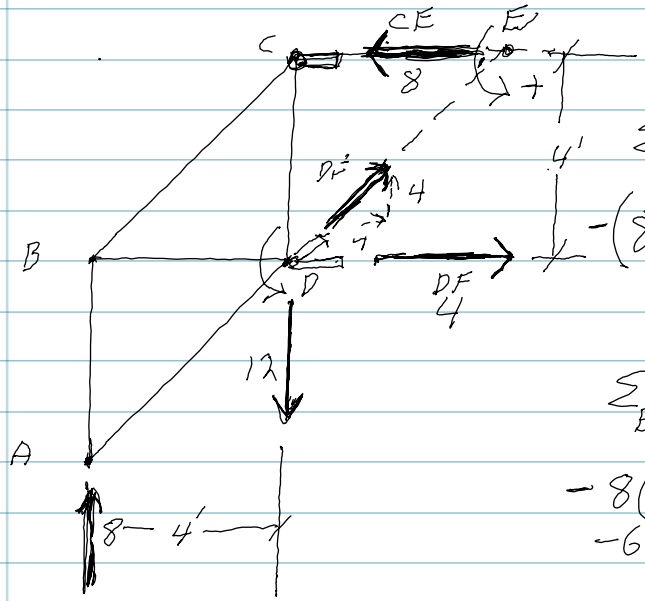
FIND: CE, DF, DE



$\Sigma F \cdot \hat{n}_\perp = 0$

$-(12)4 + (R_H)12 = 0$

$R_H = 4$ KIPS $\quad R_A = 8$ K



$\Sigma_D F \cdot \hat{n}_\perp = 0$

$-(8)4 + CE(4) = 0$

$CE = 8$ KIPS (C)

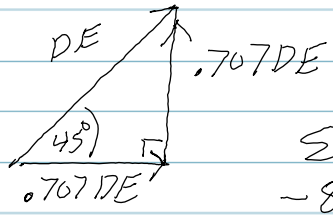
$\Sigma_E F \cdot \hat{n}_\perp = 0$

$-8(8') + (12)4 + DF(4) = 0$

$-64 + 48 + 4DF = 0$

$DF = 4$ KIPS (T)

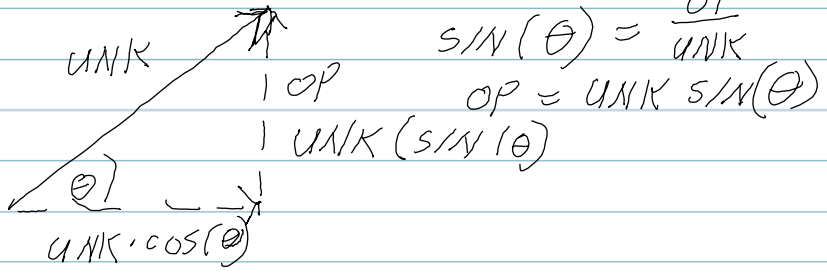
$DE = \sqrt{4^2 + 4^2} = \sqrt{32} = 5.66$ KIPS (T)



$\Sigma F_x = 0$

$-8 + .707DE + 4 = 0$

VIP



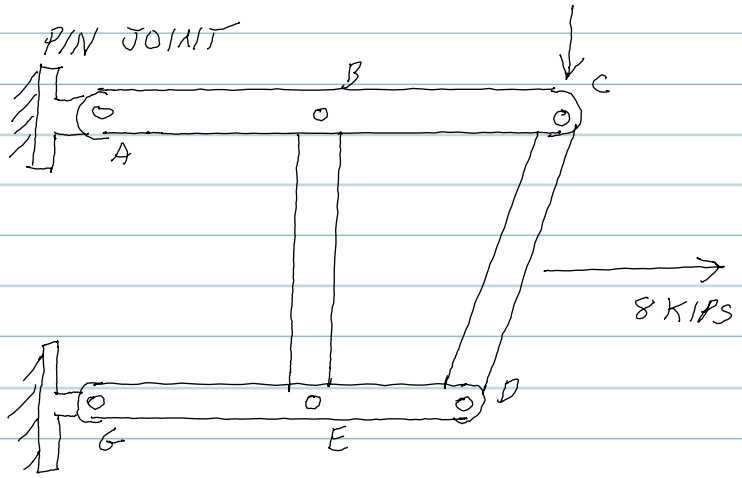
$SIN(\theta) = \frac{OP}{UNK}$

$OP = UNK\ SIN(\theta)$

DONE

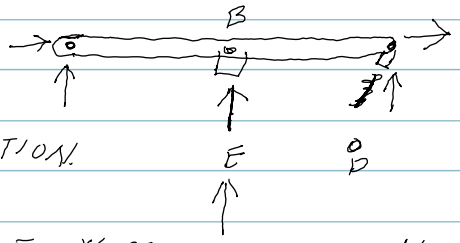
CH. 6 SECTION 6.5 FRAMES & MACHINES

TRUSSES
FRAMES
MACHINES

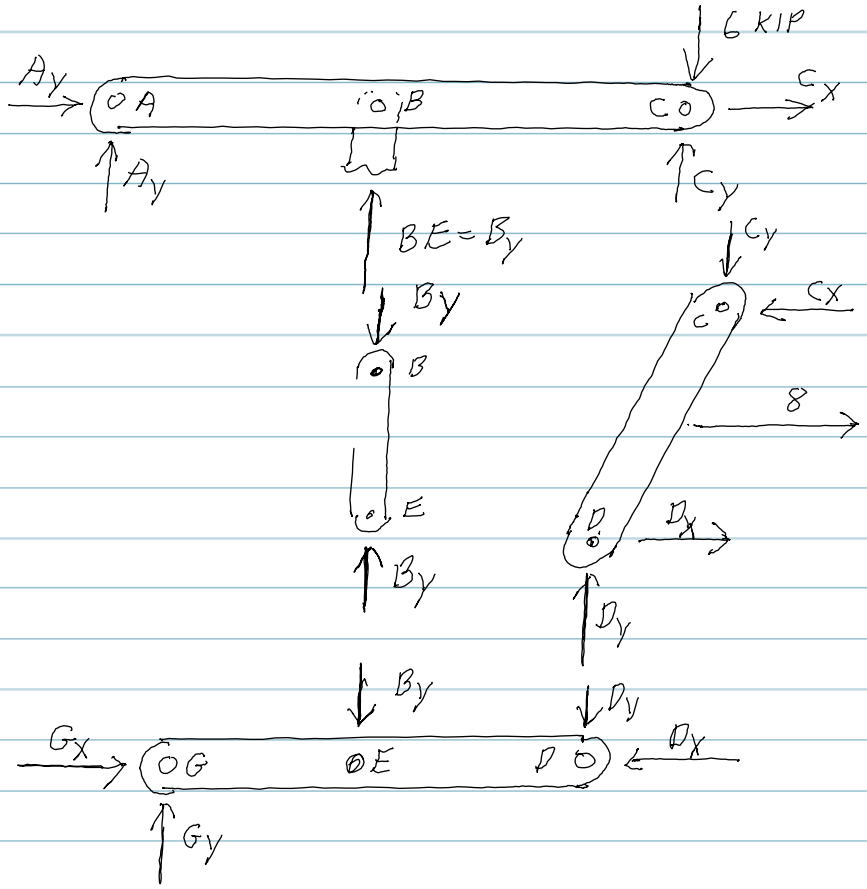


TRUSS a) EVERY MEMBER 2 FORCE
b) TRIANGULATED
c) LOAD APPLIED ONLY AT JOINTS

FRAME — a) 3 FORCE MEMBERS OR MORE — ABC
b) BENDING MOMENTS @ SOME JOINT FOR SOME SECTION



MACHINE — MOVING PARTS - 3 FORCE MEMBERS OR MORE



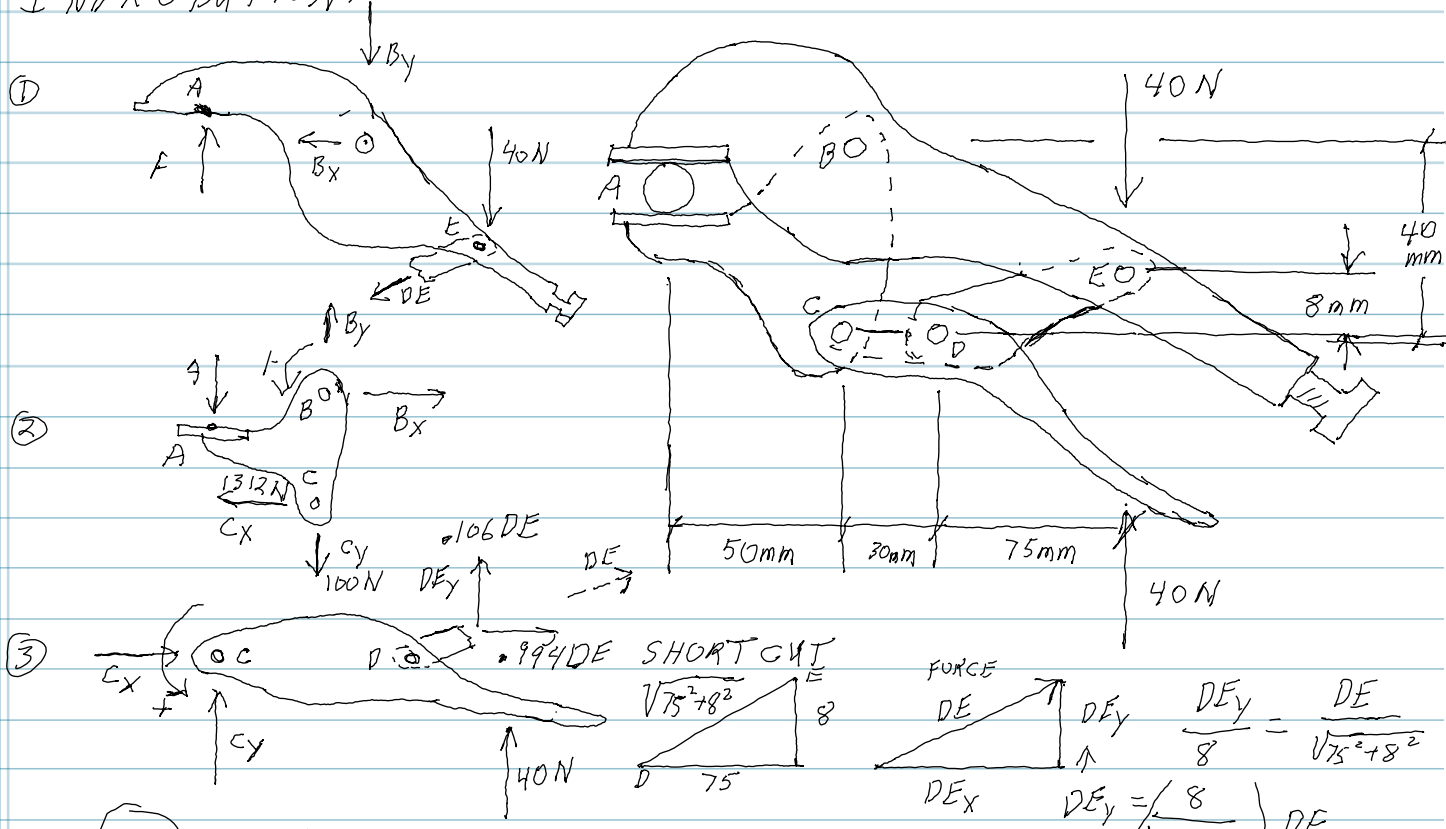
2 UNK'S A_x, A_y
1 " B_y
2 " C_x, C_y
5 UNK'S

2 UNK D_x, D_y

2 UNK G_x, G_y

CH 6 PROB. 6-108 MACHINE ANALYSIS

INTRODUCTION:



SHORT CUT

FORCE

$$\frac{DE_y}{8} = \frac{DE}{\sqrt{75^2+8^2}}$$

$$DE_y = \left(\frac{8}{\sqrt{75^2+8^2}}\right) DE$$

$$DE_y = \left(\frac{75}{\sqrt{75^2+8^2}}\right) DE$$

FBD (#3) $\Sigma M_C = \Sigma F \cdot l_1 = 0$

$+(.106DE)\,30 + (40)(105) = 0$

$DE = -1320\ N$

$\Sigma F_y = 0$

$+C_y + .106\,DE + 40 = 0$

$C_y + .106(-1320) + 40 = 0$

$C_y = 100\ N$

$\Sigma F_x = 0$

$C_x + .994\,DE = 0$

$C_y + .994(-1320) = 0$

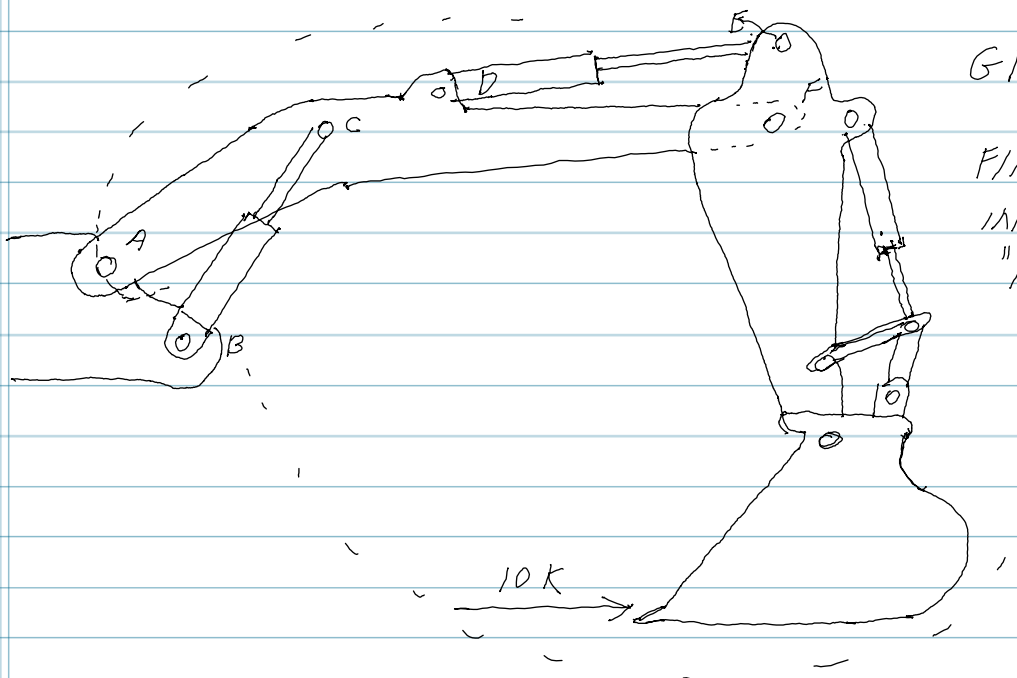
$C_x = 1312\ N$

FBD (#2) $\Sigma M_b = 0 \Rightarrow +(A)\,50 - (1312)\,40 = 0 \Rightarrow A = 1050\ N$

MECHANICAL ADVANTAGE: $MA = \frac{F_{JAWS}}{F_{INPUT}} = \frac{1050\ N}{40N} = 26$

LOCKING KNEE

CH 6. PROB. 6-113 HOW TO THINK ABOUT THE SELECTION OF A FBD



GIVEN:

FIND: FORCES IN JOINTS "A" & "E"

$A_x = -.29$ KIPS $\quad A_y = 19.4$ KIPS $\quad T_{BC} = 21.7$ KIPS

$F_x = 59.2$ KIPS $\quad F_y = 2.34$ KIP $\quad T_{DE} = -49.2$ K

OC 21.7 KIP ↙ OE → COMP.