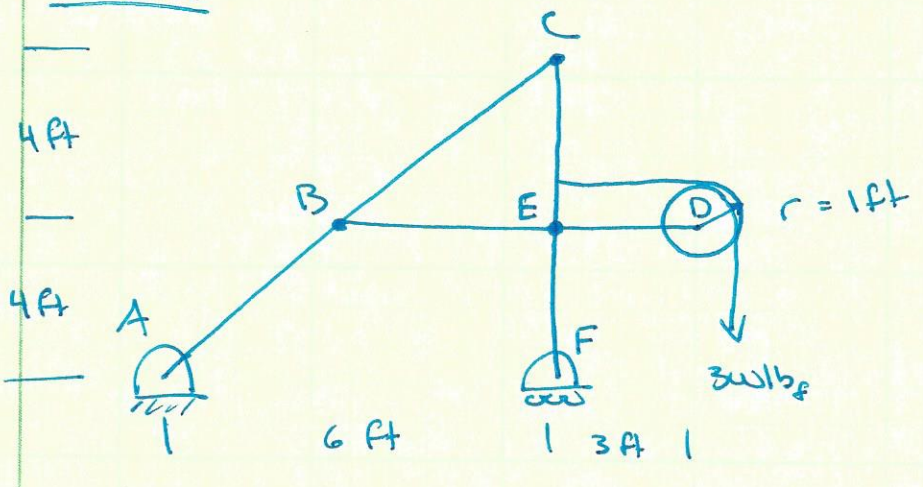
Given



Find

- Reactions @ A & F
- Horizontal force @ C that member ABC exerts on member CEF

Expected solution

- A + F reactions will be only in y-direction
- Expect F to be ↑ and A to be ↓
- Expect that C_x will be to the right

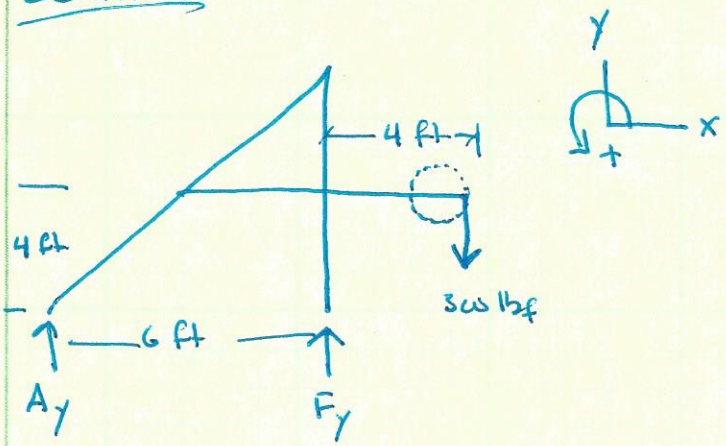
Plan

ΣM_A of assembly to find $\vec{F}$

ΣM_F of assembly to find $\vec{A}$

ΣM_E of member CEF to find C_x

Solution



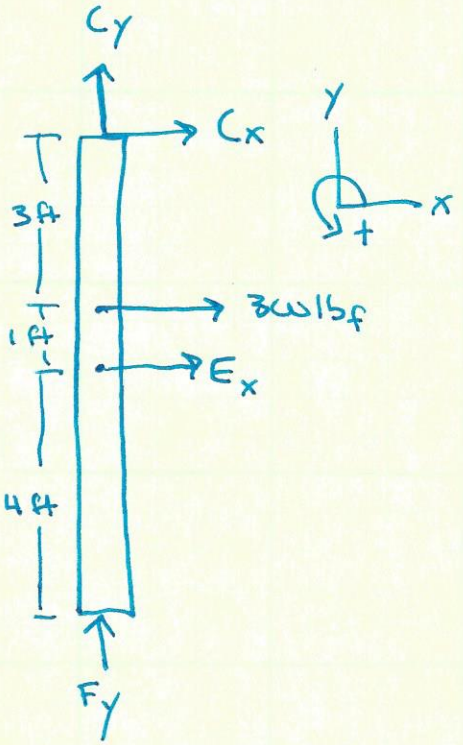
$$\Sigma M_A = 0 = F_y(6\,ft) - (300\,lb_f)(10\,ft)$$

$$\boxed{F_y = 500\,lb_f} \uparrow$$

$$\Sigma M_F = 0 = -A_y(6\,ft) - (300\,lb_f)(4\,ft)$$

$$A_y = -200\,lb_f$$

$$\boxed{A_y = 200\,lb_f} \downarrow$$



$$\Sigma M_E = 0 = (-300\,lb_f)(1\,ft) - C_x(4\,ft)$$

$$C_x = -75\,lb_f$$

$$\boxed{C_x = 75\,lb_f} \leftarrow$$

Check

F_y should be greater than 300 lbf

A_y should be $\sim \frac{4}{6}(300\,\text{lbf})$

@ point C, FEC would be pulling to the right, so ABC should be pulling to the left.

Reflection

If all members and pins were equal size, where would you look for failure points?

I expect the vertical load @ F (and between F+E) is the highest force in the assembly

Guesses for pin forces

A = 200 lbf ↓

B = 750 lbf →

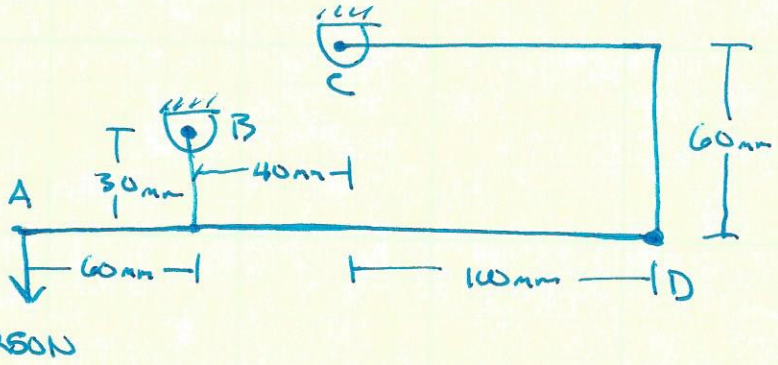
C = 750 lbf ← 750 lbf ↑ = |1060 lbf| ↗

D = 424 lbf ↗

E = 225 lbf ←

F = 500 lbf ↑

Given



Find

- Draw FBD of ABD, showing all forces on member
- Magnitude of force @ B
- Magnitude of force @ C

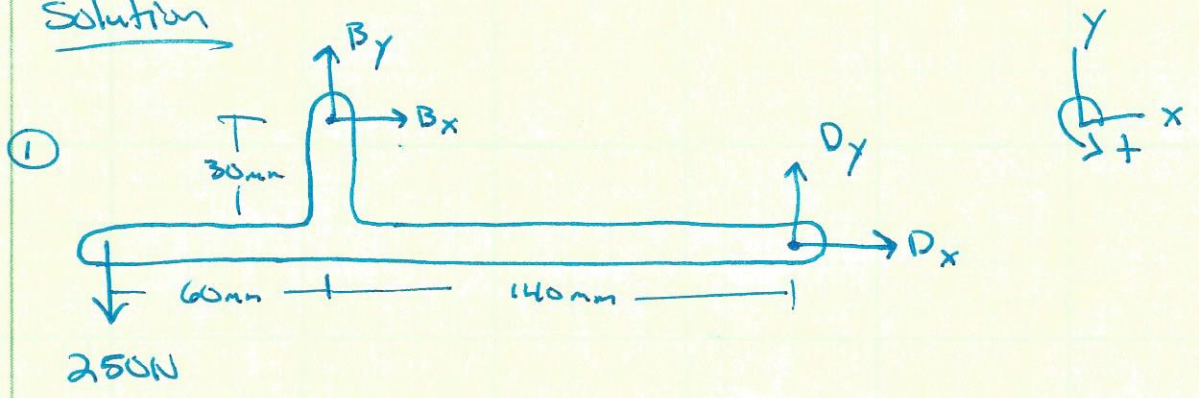
Expected Solution

- Note: CD ~~is~~ acts like a two-force member, even though not straight
- Expect $|B|$ to be much larger than 250N
- Expect $\vec{C}$ to be in direction ↘

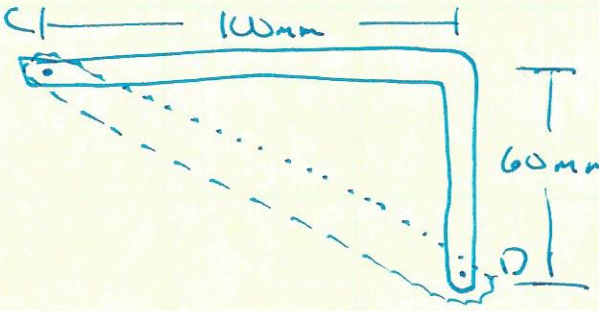
Plan

1) FBD of ABD
2) ΣM around B to find $\vec{D}$ (treat CD like two-force member)
3) ΣF_x to find B_x
4) ΣM around D to find B_y
5) $\vec{C} = -\vec{D}$

Solution



CD is a two-force member



$\rightarrow D_x = \frac{100}{60} D_y$

② $\Sigma M_B = 0 = (250N)(60mm) + D_y(140mm) + D_x(30mm)$

$0 = 15{,}000 N\cdot mm + D_y(140mm) + 1.67 D_y(30mm)$

$0 = 15{,}000 N\cdot mm + D_y(140mm - 50.1mm) = 0$

$D_y = -166.7 N$

$\boxed{D_y = 166.7 N \downarrow}$

$\boxed{D_x = 277.8 N \rightarrow}$

③ $\Sigma F_x = 0 = B_x + 277.8N$

$B_x = -277.8 N$

$\boxed{B_x = 277.8 N \leftarrow}$

Solution cont.

④ $\Sigma M_D = 0 = (250N)(200mm) + (277.8N)(30mm) - B_y(140mm)$ (B_x)

$$B_y = 416.7N \uparrow$$

$$|\vec{B}| = \sqrt{(277.8)^2 + (416.7)^2} \ N$$

$$|\vec{B}| = 500.8N$$

⑤ $|\vec{D}| = |\vec{C}| = \sqrt{(166.7)^2 + (277.8)^2}$

$$|\vec{C}| = 324N$$

Check

- Magnitudes are reasonable, and in directions expected
- Orientation of CD is reason the other pin forces are so high

Reflection

- The closer B & C are to each other, the higher the pin forces are going to be.
- Want to make $D_y = \infty$? Make the member CD have $-\frac{x}{y} = 4.67$ (in line with BD)