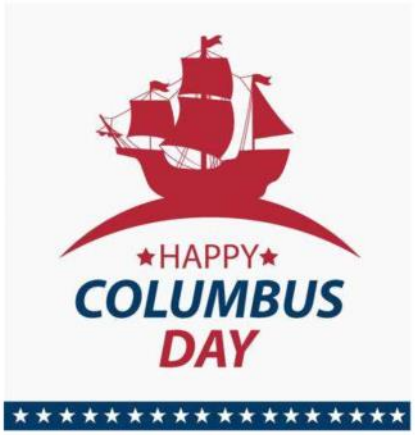
# Announcements

- Quiz 3 this week.

- Upcoming deadlines:
- Tuesday (10/9)
  - PL HW
- Friday (10/12)
  - WA

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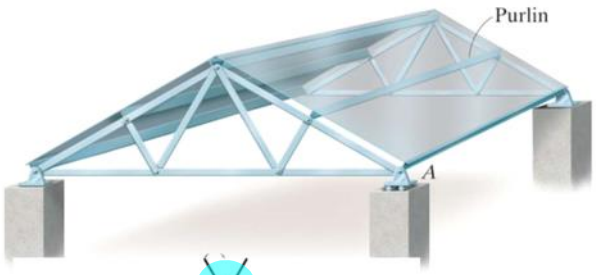
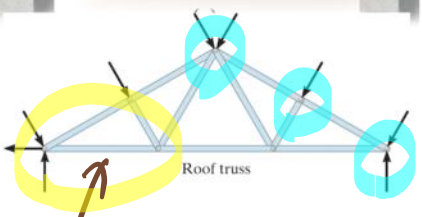
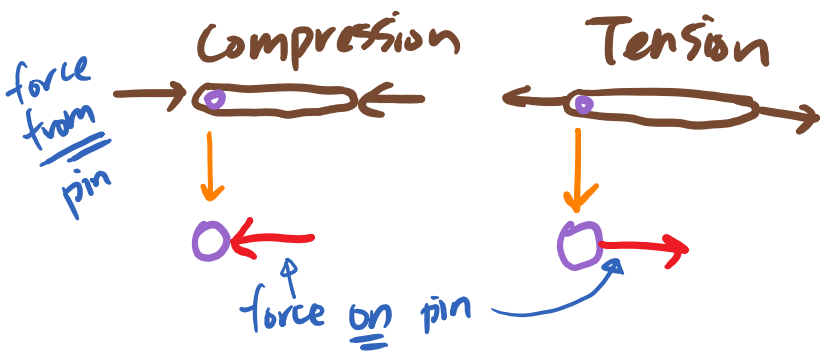
# Objectives

- Truss Analysis
  - Method of joints/pins example
  - Zero force member




2-force member

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# Tension vs. Compression

Rigid bodies respond differently to tension versus compression. (YouTube Clips)

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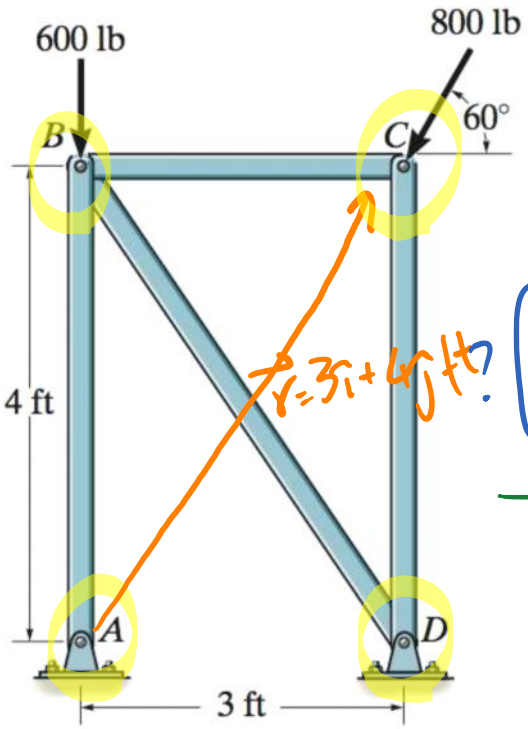


Find the forces in member *BD*.

$r = 3i + 4j$ ft

$r_D$

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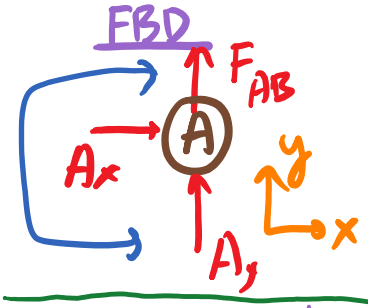
## Pin Analysis




EoE

$\Sigma F_x = A_x = 0$

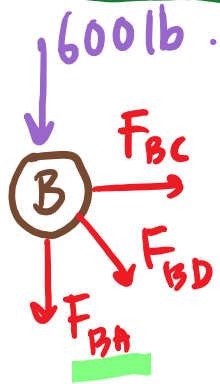
$\Sigma F_y = F_{AB} + A_y = 0$

$\rightarrow F_{AB} = -A_y$

$F_{AB} = -1133$ lb

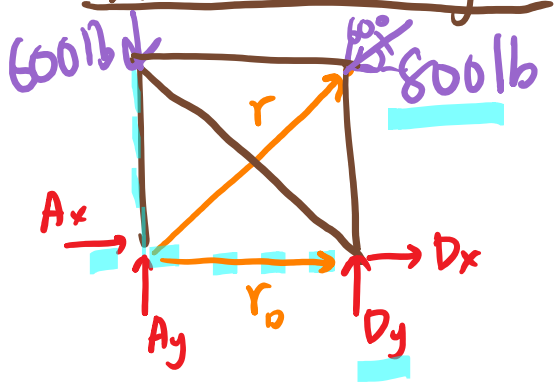
in compression.

from structural analysis




Assume → tension.

## Structure Analysis




EoE

$\Sigma F_y = -600\text{lb} - F_{BA} - F_{BD}\left(\frac{4}{5}\right) = 0$

$F_{BD} = \frac{[-600\text{lb} - (-1133\text{lb})]5}{4}$

$F_{BD} = +667$ lb tension

from pin A analysis.

3 EoE *0

① $\Sigma F_x = 0 = A_x + D_x + (-800\cos 60°) \rightarrow D_x = 800\cos 60° = 400$ lb

② $\Sigma F_y = 0 = A_y + D_y - 600\text{lb} - 800\sin 60°$ lb $\rightarrow A_y = 600 + 800\sin 60° - D_y$

② $\sum F_y = 0 = A_y + D_y - 600\,lb - 800\sin 60°\,lb \rightarrow A_y = 600 + 800\sin 60 - D_y$

③ $\sum M_A = 0 = +D_y(3\,ft) + (800\cos 60°)(4\,ft) - (800\sin 60°)(3\,ft)$

$D_y = \dfrac{800(3\sin 60 - 4\cos 66°)}{3\,ft}$

$F_x$ | $r_y$ → + moment

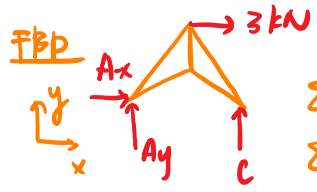
$r_x$ | $F_y$ → − moment

$D_y \approx 160\,lb$ → ② $A_y \approx 1133\,lb$

We will determine the force in each member of the truss and indicate whether the members are in tension or compression.

Structure Analysis (find reaction supports at A & C)

FBD




EoE

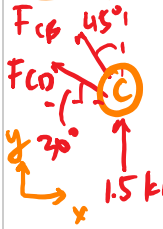
$\Sigma F_x = 0 = A_x + 3\,kN \rightarrow \boxed{A_x = -3\,kN}$

$\Sigma F_y = 0 = A_y + C \rightarrow \boxed{A_y = -C = -1.5\,kN}$

$\Sigma M_A = -(2m)(3kN) + (4m)C \rightarrow \boxed{C = +1.5\,kN}$

Joint C Analysis

FBD

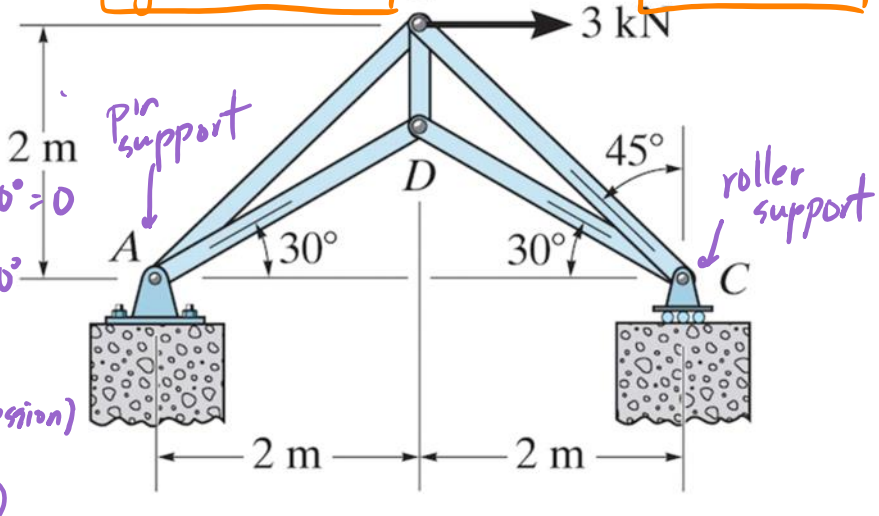



EoE

$\Sigma F_x = -F_{CB}\sin 45° - F_{CD}\cos 30° = 0$

$\Sigma F_y = F_{CB}\cos 45° + F_{CD}\sin 30° + 1.5\,kN = 0$

$\rightarrow \begin{cases} F_{CB} = -5.02\,kN \text{ (compression)} \\ F_{CD} = 4.10\,kN \text{ (tension)} \end{cases}$

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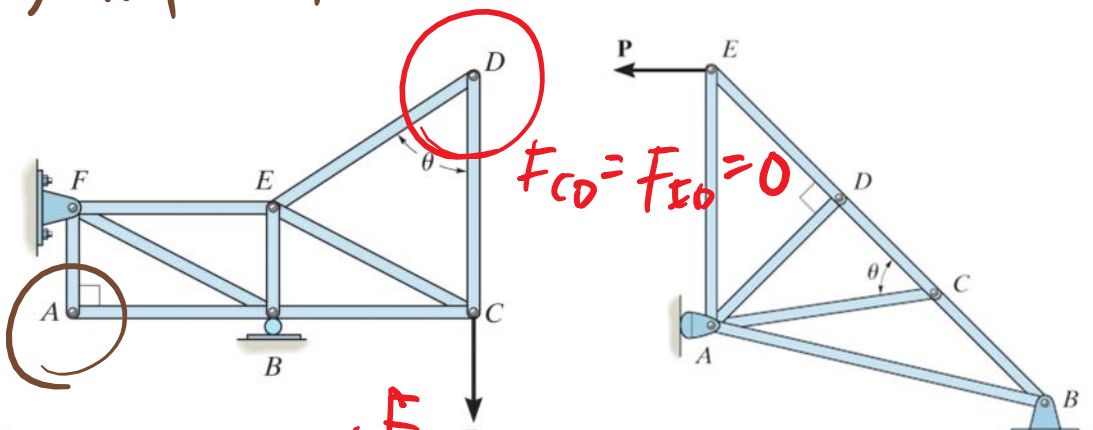
# Zero-force members

- Particular members in a structure may experience no force for certain loads.
- Zero-force members are used to increase stability
- Identifying members with zero-force can expedite analysis.

1) A pin w/ 2 members & no external force




$F_{CD} = F_{EC} = 0$

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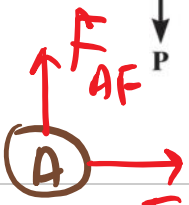
Pin A




$F_{AF} = F_{AB} = 0$