Announcements

- Quiz 3 retry continues through Saturday.

☐ Upcoming deadlines:
  - Friday (3/1) – TODAY!
    - Written Assignment
  - Tuesday (3/5)
    - PL HW
Example

\( F_{ED} = 3000 \text{ N in compression}, \text{ determine } F_{EB}. \)

Use cut b-b:

\[ \begin{align*}
\Sigma F_x &= -F_E \cos 30^\circ - 3000 \cos 30^\circ \\
&= 0 \quad \rightarrow \quad F_E = -3000 \text{ N or } 3000 \text{ N (compression)}
\end{align*} \]

\[ \begin{align*}
\Sigma F_y &= -F_E \sin 30^\circ - F_{EB} + 3000 \sin 30^\circ - 1000 \text{ N} = 0 \\
&\rightarrow \quad F_{EB} = 2000 \text{ N (tension)}
\end{align*} \]
Determine the force in members $BG$, and state if the members are in tension or compression.

Strategy: method of section (the member is in the middle of a large truss)

- Cut through $BG$ + 2 more members

$\sum F_x = 0 = F_{BG} \cos 45^\circ + 5\text{kN} + 10\text{kN} + 10\text{kN}$

$F_{BG} = \frac{-25\text{kN}}{\cos 45^\circ}$ (compression)
Determine the force in members $DE$, and state if the members are in tension or compression.

Strategy: method of pins
(connected to a pin with a load and one other member only)

- Use pin $D$

$\Sigma F_x = 0 = F_{DE \cos 45^\circ} + 5\, \text{kN}$

$F_{DE} = \frac{-5\, \text{kN}}{\cos 45^\circ}$ (compression)
Determine the force in members $BE$ and state if the members are in tension or compression.

**Strategy:**

A) Method of pins

B) Method of section & cut through

C) Method of section & cut through

D) Method of section & cut through

E) Other method. (EFM rules)

$F_{FB} = 0$.  

$F_{FB}$
Frames and machines

Frames and machines are two common types of structures that have at least one multi-force member (Recall that trusses have nothing but two-force members).

Frames are generally stationary and used to support various external loads.
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Machines contain moving parts and are designed to alter the effect of forces.
Frames and machines

The members can be truss elements, beams, pulleys, cables, and other components. The general solution method is similar to rigid body at equilibrium analysis:

1. Identify the structure member with force/moment of interest loading on it.
2. Perform equilibrium analysis on the whole structure to find support reactions if necessary.
3. Perform equilibrium analysis on identified member of the structure.

Example:

Find the force acting at $B$ on member $BC$. 
Draw the FBD of the members of the backhoe. The bucket and its contents have a weight $W$. 
Example

Determine the force in the cable at winch motor \( W \).

1.) ID rigid body interacting w/ force(s) of interest.

\[ \Sigma F_y = 27 - 700 \text{ lb} = 0 \]

\[ T = 350 \text{ lb}. \]
Determine the force acting at $A$, $B$, and $C$ on member $ABC$.

1. ID rigid body of interest.