Announcements

- Visual representation study consent form in PL HW

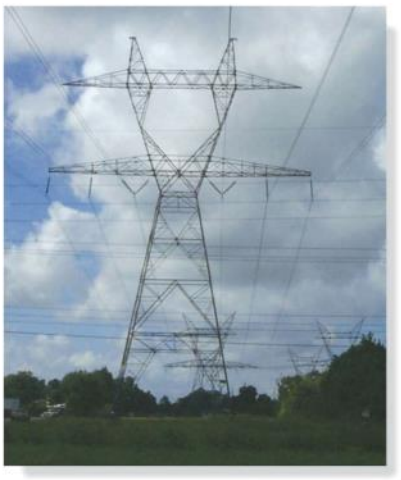
~ 1% overall final grade extra credit

- Upcoming deadlines:
- Friday (10/12)
  - Written Assignment
- Tuesday (10/16)
  - PL HW

1

Objective

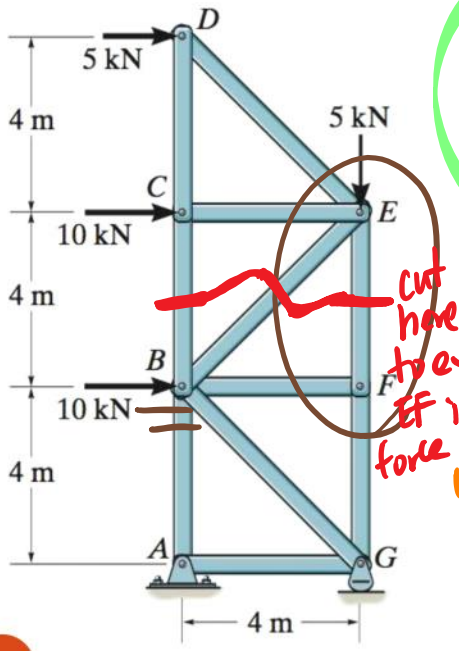
- Truss Analysis – Method of Sections
- Frame & Machine Analysis

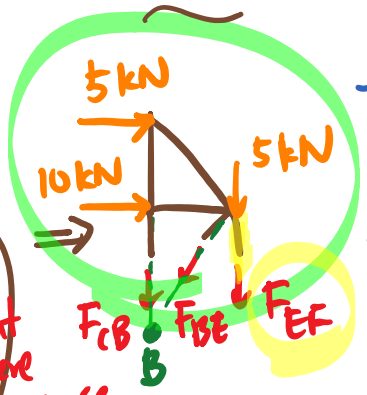


2

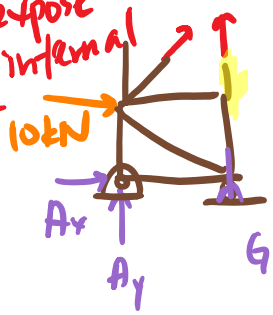
Example

Determine the force in member *EF* for the truss below.





cut here to expose EF internal force



Top piece has 3 unknowns
F_{CB}, F_{BE}, F_{EF}

Bottom piece has 6 unknowns
F_{CB}, F_{BE}, F_{EF}, A_x, A_y, G

→ Choose top piece

E.o.E

$\Sigma M_B = -10\,kN\,(4m) - 5kN\,(8m) - 5\,kN\,(4m) - F_{EF}\,(4m) = 0$

→ $F_{EF} = -25\,kN$

compression

3

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.

7

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).

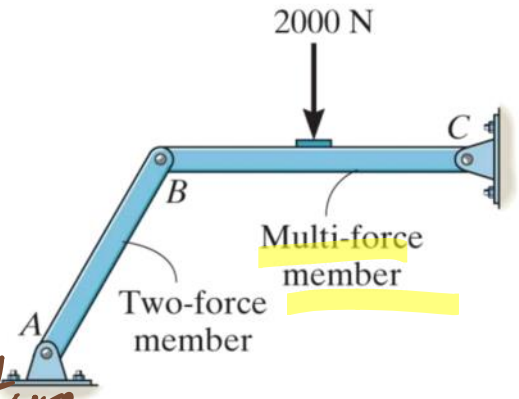
Machines contain **moving parts** and are designed to alter the effect of forces.

8

Friday, October 12, 2018 11:49 AM

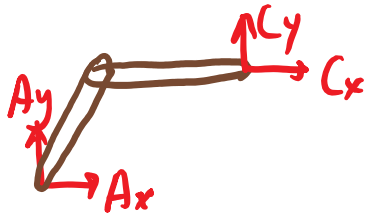
Frames and machines

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



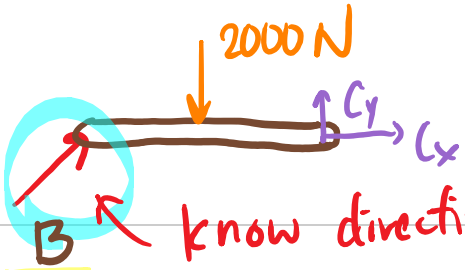
1.) Use FBD to find support reactions to the whole structure

FBD



2.) Identify/isolate the member to find forces of interest

FBD : BC



know direction for 2-force member

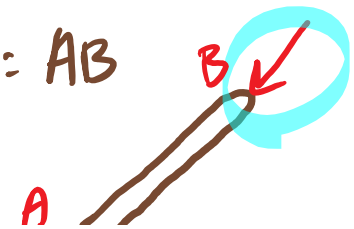
3.) Use EoE to solve for F.

Important Tools:

1). ID 2-force members

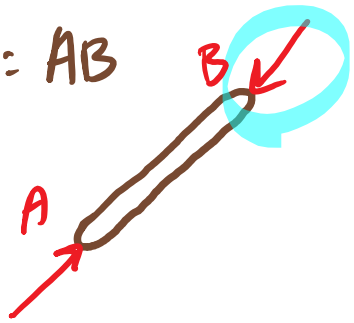
2) Remember Newton's 3rd Law.

FBD : AB



~ equal & opposite to $\vec{B}$ on member BC.

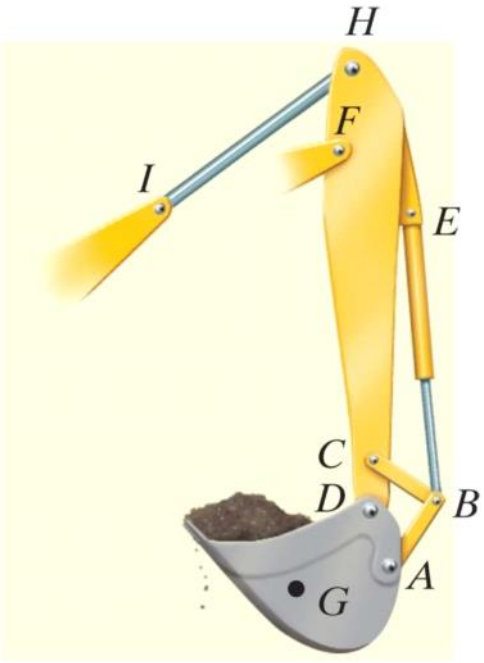
FBD: AB



~ equal & opposite to $\overline{B}$ on member BC.

Friday, October 12, 2018 11:49 AM

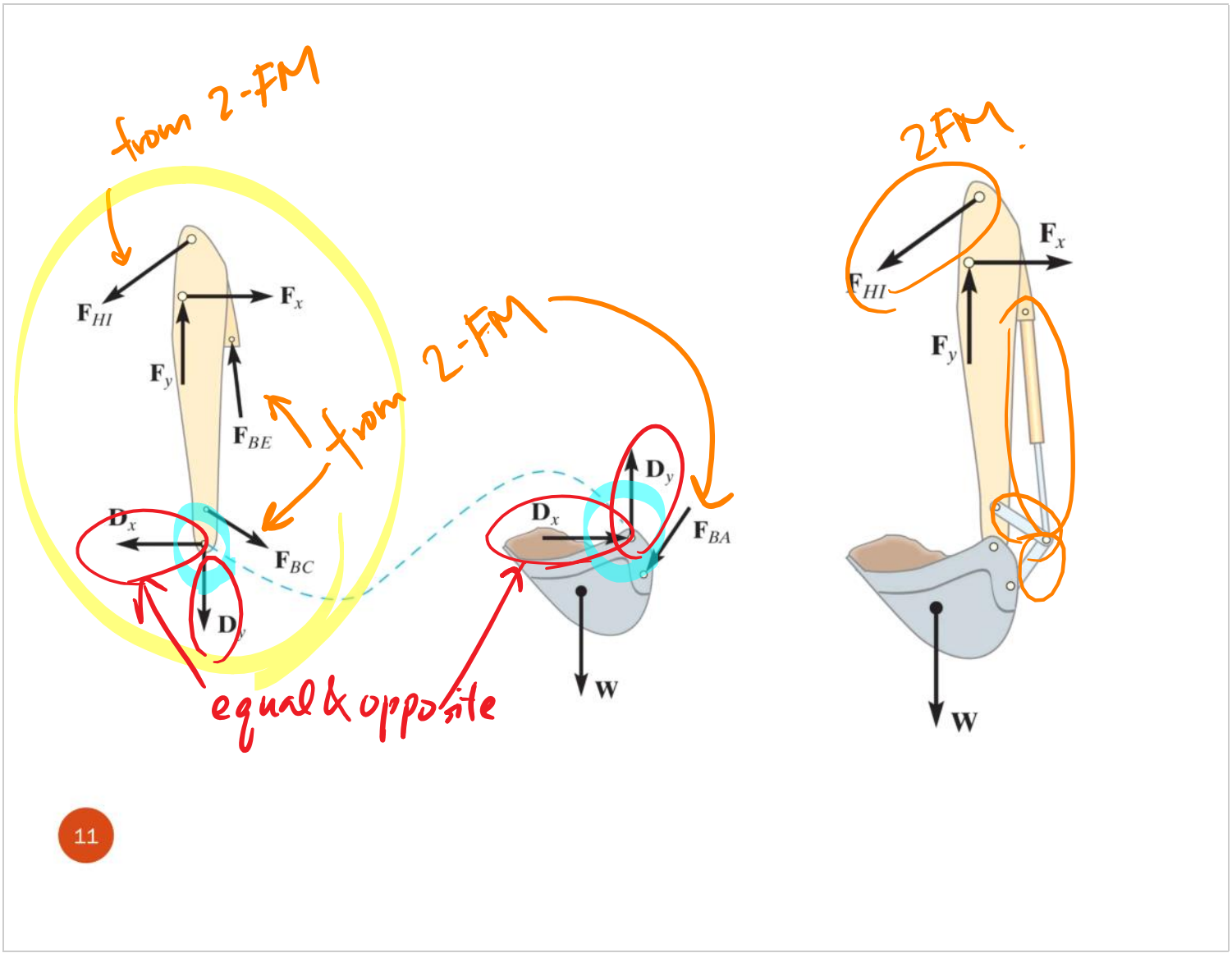
Draw the FBD of the members of the backhoe. The bucket and its contents have a weight W.



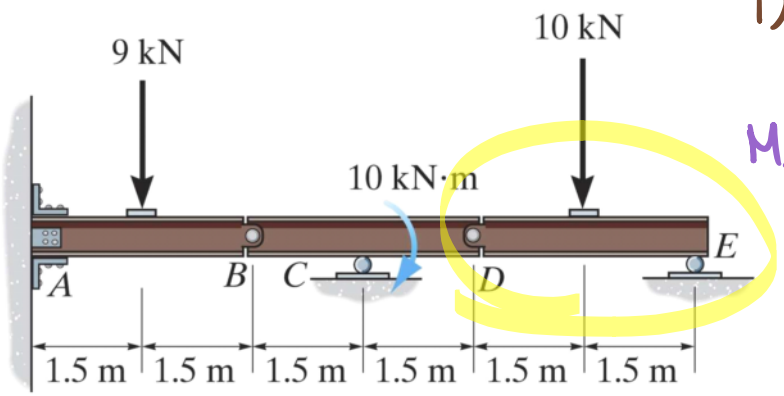
4 2-force members: HI, EB, AB, BC

10

Friday, October 12, 2018 11:49 AM

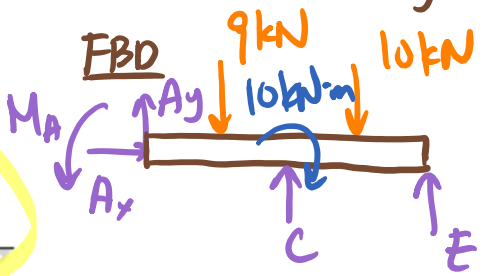


Find support force at E.



1) Structure Analysis

FBD



EoE

$\Sigma F_x = \boxed{A_x = 0}$

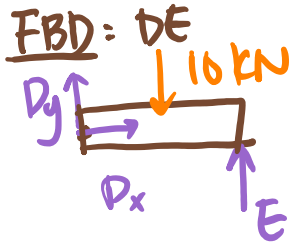
$\Sigma F_y = A_y - 9kN - 10kN + C + E = 0$

$\Sigma M_{@A} = M_A - (9kN)(1.5m) + C(4.5m) - (10kN)(7.5m) + E(9m) - 10kN\cdot m = 0$

~ To many unknowns to solve for E.

2.) Isolate a member

FBD: DE



EoE

$\Sigma F_x = \boxed{D_x = 0}$

$\Sigma F_y = D_y + E - 10kN = 0$

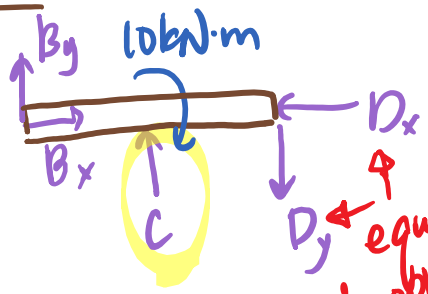
$\Sigma M_D = -(10kN)(1.5m) + E(3m) = 0$

$\boxed{E = 5\ kN} \rightarrow \boxed{D_y = 5\ kN}$

~ If we were to find support at C, use member BD for analysis

FBD: BD EoE

FBD : BD



D_x & D_y ↑ equal & opposite from forces on DE. →

ΣE of E

$\Sigma M_B = C(1.5m) - 10kN \cdot m - D_y(3m) = 0$

$C = 16.7\ kN$